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Environmental Protection
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Office of Solid Waste and
Emergency Response
Washington DC 20460

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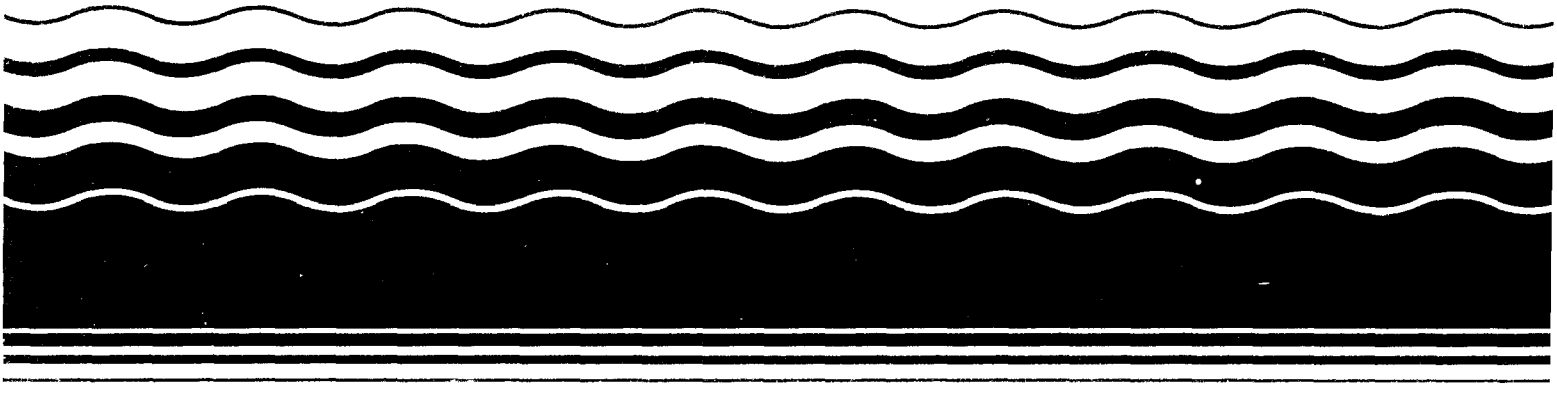
Superfund

EPA

Study of Joint Use of Vehicles for Transportation of Hazardous and Nonhazardous Materials

Report to Congress



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April 1987

STUDY OF JOINT USE OF VEHICLES FOR TRANSPORTATION OF HAZARDOUS AND NONHAZARDOUS MATERIALS

A Report to Congress

Office of Emergency and Remedial Response
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
Washington, D.C. 20460

EXECUTIVE SUMMARY

Section 118(j) of the Superfund Amendments and Reauthorization Act of 1986 (SARA) requires the Administrator of the Environmental Protection Agency (EPA), in consultation with the Secretary of Transportation, to conduct a study and report to Congress on the problems associated with the joint use of vehicles for transportation of both hazardous and nonhazardous substances.

FINDINGS AND RECOMMENDATIONS

The Agency identified only a small number of joint-use contamination incidents reported over a 30-year period in the United States, and determined that the existing regulatory and nonregulatory incentives to minimize or avoid contamination were sufficient so that it appears inappropriate at this time to recommend further prohibition of the joint use of vehicles. Existing Department of Transportation (DOT), EPA, and Food and Drug Administration (FDA) regulations provide certain safeguards that reduce the risk of joint-use contamination and the threat to public health and the environment. The Agency also is not recommending at this time any further study of the joint-use issue. EPA and DOT do not believe any special safeguards need to be implemented. Although further research may uncover additional incidents of joint-use contamination, the Agency believes that further study will not alter the fundamental conclusion of this report that joint use of vehicles to transport hazardous and nonhazardous materials is not a significant problem. If Congress believes, however, that because of the short time frame available for this study, potential areas may have been overlooked, the Agency has identified the following data sources where additional transportation incidents may be documented:

- EPA Regional and State data pertaining to sludge transportation; and

- Contamination incidents identified by State health and agricultural organizations, as well as other Federal agencies.

Insufficient information exists at this time to recommend that "special safeguards should be taken to minimize threats to public health and the environment" caused by joint-use contamination incidents (SARA Section 118(j)(1)(B)). While the Agency does not recommend any additional studies at this time, the Agency recognizes that the scope of this study was limited. However, in the course of conducting this study, the Agency has identified the following potential areas that could be considered as part of any subsequent review of this issue:

- Examine requiring carriers to inform shippers of nonhazardous materials that the previous shipment

contained hazardous materials, and whether and how the nondedicated vehicle was cleaned.

- Examine the extent to which generic decontamination standards and/or substance-specific decontamination standards may be needed for substances of greatest concern that might pose a high risk, such as pesticides contaminating food and fiber products.

- Examine the extension of marking regulations applicable currently to tank cars and cargo tanks to other bulk vehicles, particularly dump trucks and chassis-mounted roll-off refuse containers. (DOT is presently considering such a regulation.)

- Examine the need for requiring additional protection or prohibit the simultaneous transportation of foodstuffs and nonpoisonous hazardous materials that exhibit harmful characteristics (e.g., potential carcinogenicity and chronic toxicity). Such an approach would be similar to the existing DOT regulations for poisons in trucks and rail cars.

- Examine the need for requiring liners for certain vehicles such as dump trucks when transporting hazardous materials.

- Examine the need for prohibiting inadequate or insufficient cleaning procedures that may contribute to improper disposal of hazardous contaminants or may pose a threat to a subsequent shipment of nonhazardous goods.

- Encourage the growth of the truck and rail car cleaning industries to promote better cleaning practices to reduce the likelihood of contamination, especially during the back haul.

Finally, the following two areas were considered to be beyond the scope of this study: joint use of vessels (i.e., watercraft) to transport hazardous and nonhazardous materials, and the effectiveness of compliance with and enforcement of existing regulations.

SCOPE AND STUDY APPROACH

In defining the scope of the study, EPA had to establish the appropriate class of transport vehicles and the universe of hazardous substances of concern. The Agency determined that the appropriate class of vehicles to study includes both trucks and rail cars. DOT regulations cover both rail and

motor vehicle transportation and these two modes of transportation share some of the same problems. In addition, a review of the regulatory requirements of one mode may suggest solutions to any gaps in the regulatory framework of the other. So as not to limit in any way the investigation of the joint-use issue, EPA sought to define the universe of hazardous contaminants covered by this study as broadly as possible to include hazardous materials and hazardous substances, as defined in DOT regulations (49 CFR §171); hazardous substances, as defined by CERCLA Section 101(14); extremely hazardous substances as defined by SARA Section 302; hazardous chemicals and toxic chemicals identified in SARA Sections 311 and 313; and other substances that may pose a threat to public health and the environment when released, misused, or otherwise mishandled.

The Agency's approach to the study consisted of first determining whether or not, and to what extent, a problem exists. This assessment was composed of four elements: (1) a determination of the quantity of hazardous contaminants transported annually in the United States, and how these quantities are divided among the various modes of transportation; (2) an investigation of the history of joint-use incidents, to the extent available, to place the problem in perspective; (3) a determination of the potential problem, including a categorization of hazardous contaminants; and (4) a development of scenarios that illustrate the potential for harm to human health and the environment.

Second, the Agency reviewed existing Federal and State regulations to assess the extent to which existing regulations provide ample protection against joint-use contamination and to identify potential regulatory gaps, if any.

Finally, the Agency conducted interviews to assess industry practices and the incentives that lead to those practices. Representatives from industry and carrier categories, trade associations, Federal, State, and local governments, and others involved in hazardous materials transportation were identified and contacted.

ASSESSMENT OF THE EVIDENCE

In assessing the extent of the problem, three situations were analyzed that could cause contamination of nonhazardous goods during transportation: (1) residue remaining after a bulk shipment of a hazardous material causing contamination of a subsequent shipment of a nonhazardous good in the same vehicle; (2) a spill during a package shipment of a hazardous material causing contamination of a subsequent package shipment of a nonhazardous good in the same vehicle; and (3) a spill during a simultaneous shipment of packages of a hazardous material and packages of a nonhazardous good. In spite of a broad and careful search for incidents, over a 30-year period only 18 documented cases of transportation-related contamination of nonhazardous goods by hazardous materials were identified. Of these 18 cases, only 6 incidents occurred in the United States. Five additional undocumented incidents were

described by people contacted during the study. The small number of incidents identified in this study suggest that joint-use contamination may not be a significant problem.

There are reasons to believe, however, that not all joint-use contamination incidents have been discovered due to the difficulty in identifying the source of contamination or because the consequences of contamination are not evident immediately. In addition, the investigation of the extent of the potential problem was hindered somewhat by the lack of a comprehensive data base related to joint-use incidents. Consequently, while the evidence evaluated to date indicates that the problem of joint-use contamination is minor, such evidence is not conclusive.

REGULATORY COVERAGE AND POTENTIAL GAPS

Federal regulations provide some protection from contamination resulting from bulk as well as from package shipments of hazardous material. DOT and EPA regulations require reporting to the Federal government of releases from packaged hazardous materials and hazardous substances. In addition, certain Federal regulations expressly require cleaning of transport vehicles if a spill from a packaged hazardous material occurs. For example, DOT regulations provide that any spill of a hazardous material in a rail car must be removed. DOT regulations also prohibit simultaneous transportation in the same rail car of any package labeled as a poison and any foodstuff. FDA regulations requiring inspection and cleaning of foodstuffs and drugs to remove surface contaminants may reveal or remedy contamination. It therefore appears that regulatory coverage exists to protect some products from contamination caused by spills of packaged hazardous contaminants.

Despite the existing Federal regulations requiring notification, placarding, marking, and labeling for hazardous materials in general, and the cleaning and dedication regulations that exist for poisons in rail cars, the regulatory coverage for bulk shipments is not as complete as it is for packaged shipments. Placarding and marking requirements may provide the shipper with an indication of what was carried previously in the vehicle but these regulations were instituted to protect against other dangers and may not be a consistent, reliable method of informing shippers of the potential danger involved in loading the bulk vehicles with nonhazardous goods. In addition, the placarding, marking, and labeling requirements are not universal; for example, vehicles such as dump trucks carrying certain hazardous materials do not have to be placarded or marked. Moreover, FDA inspection regulations may not be sufficiently stringent to uncover all forms of contamination.

A review also was conducted of selected State regulations in this area. These regulations also provide some protection from joint-use contamination.

INDUSTRY PRACTICES

The gaps identified in the existing regulatory coverage, however, could be at least partially filled by nonregulatory incentives for shippers, carriers, and receivers to clean a vehicle or to take other precautions to prevent contamination of nonhazardous materials. For example, shippers of Grade A milk products have voluntarily established certain cleanliness standards for transportation of their products so that the value of these products will be preserved. In addition, the threat of statutory and common law liability may influence shippers, carriers, and receivers to observe safety practices beyond those required by regulation. Finally, the desire to maintain a positive corporate image may be an incentive for precautionary industry practices, as one contamination incident can gravely damage a corporate reputation and thus jeopardize future business.

Although these incentives for observing safety precautions exist, other market forces may lead to an increased likelihood of contamination resulting from joint use. For example, competitive pressures on the trucking industry encourage back hauling of dissimilar materials and discourage expensive cleaning procedures. In addition, marginally viable carriers operating in rate-sensitive markets may present a problem because such carriers have little to lose financially and may not be affected by the pressure from potential liability should contamination occur. The Agency believes, however, that further study or regulatory action at this time is not warranted and recommends, therefore, that no further action be taken.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF EXHIBITS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND PURPOSE

This Report to Congress documents the results of a study of the joint use of vehicles for transportation of both hazardous and nonhazardous materials. The study and this report are mandated by Section 118(j) of the Superfund Amendments and Reauthorization Act of 1986 (SARA), P.L. 99-499. Specifically, Section 118(j) states:

> (j) Study of Joint Use of Trucks. --
>
> (1) Study. -- The Administrator, in consultation with the Secretary of Transportation, shall conduct a study of problems associated with the use of any vehicle for purposes other than the transportation of hazardous substances when that vehicle is used at other times for the transportation of hazardous substances. At a minimum, the Administrator shall consider. --
>
> (A) whether such joint use of vehicles should be prohibited, and
>
> (B) whether, if such joint use is permitted, special safeguards should be taken to minimize threats to public health and the environment.
>
> (2) Report. -- The Administrator shall submit a report, along with recommendations, to Congress on the results of the study conducted under paragraph (1) not later than 180 days after the date of the enactment of this Act.

The legislative history of Section 118(j) is limited. In offering this amendment on the House floor, Representative Christopher Smith of New Jersey indicated that

> ... this amendment requires the Administrator in consultation with the Secretary of Transportation to conduct a study of the problems inherent in ... using the same trucks or other vehicle[s] for the transportation of hazardous materials and other substances such as sludge.
>
> The amendment requires the Administrator to consider whether joint use of the vehicles should be proscribed or, if it is to be permitted, what safeguards should be

promulgated to minimize risks to health and the environment. 131 Congressional Record H11193 (Daily ed. December 5, 1985).

In proposing Section 118(j), Congressional concern was voiced over truck operators using the same trucks to haul hazardous wastes and sludge. The specific issue of joint transportation of hazardous wastes and sludge is discussed in more detail in Chapter 3 of this report.

1.2 SCOPE OF THE STUDY

The language of SARA and its legislative history raise two important issues regarding the scope of this study:

(1) Is the study to be limited to the joint use of trucks or should a broader class of transport vehicles be considered; and

(2) What is the universe of hazardous contaminants of concern?

The U.S. Environmental Protection Agency (EPA) has determined that the appropriate class of vehicles to study includes both truck and rail transporters. Although the title of Section 118(j) uses the term "trucks," the text of Section 118(j) refers to "any other vehicle[s] ...". In addition, EPA believes that joint use involving rail transportation could occur and that the risks associated with joint use of rail cars may be comparable to those of motor vehicles. Finally, Department of Transportation (DOT) regulations cover rail and motor vehicle transportation in a similar, although not identical, manner. Clearly, rail and motor vehicle transportation could share some of the same problems, and review of the regulatory requirements of one mode may suggest solutions to any gaps in the regulatory framework of the other. Watercraft (i.e., vessels) are excluded from this study because they are defined separately from motor vehicles and rolling stock in Section 101 of CERCLA, and the more narrow focus of the study seemed to better reflect Congressional intent. Because hazardous materials transported by vessel represent a significant portion of all hazardous materials transportation, however, the potential for joint-use contamination aboard vessels could be the subject of a future study, as noted in Chapter 5 of this report.

Regarding the universe of hazardous contaminants covered by this study, SARA Section 118(j) refers to "hazardous substances" while the legislative history refers to both "hazardous materials" and "hazardous wastes." With this minimal and inconclusive guidance, EPA sought to define the universe of hazardous contaminants as broadly as possible so as not to limit in any way the investigation of the joint-use issue. Household hazardous waste transportation is not included in this report, however, because this is a subject of separate study by the Agency.[1] As a result, the universe of

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[1]For further information, see U.S. Environmental Protection Agency, "A Survey of Household Hazardous Wastes and Related Collection Programs," October 1986.

hazardous contaminants includes hazardous materials and hazardous substances as defined in DOT regulations (49 CFR §171); hazardous substances as defined by CERCLA Section 101(14) (including RCRA hazardous wastes); extremely hazardous substances as defined by SARA Section 302; hazardous chemicals and toxic chemicals identified in SARA Sections 311 and 313; and other substances which may pose a threat to the public health and the environment when released, misused, or otherwise mishandled.[2] This definition proved useful in defining the nature and scope of the joint-use problem, but does not correspond strictly to, and is more expansive than, current DOT regulatory requirements for transportation of hazardous contaminants. Those requirements are generally limited to a universe of DOT "hazardous materials," which includes both "hazardous wastes" and "hazardous substances." The regulatory review portion of the study, then, was generally limited to the existing regulatory requirements for the hazardous materials subset of hazardous contaminants.

1.3 STUDY APPROACH

The study sought to assess whether a problem existed with respect to the joint use of vehicles for hazardous and nonhazardous materials transportation and the extent to which the public is protected from any health and environmental risks resulting from such practices. Because the initial concern with the issue of joint use arose over the transport of sewage sludge, particular attention in the problem assessment phase of this study was focused on uncovering incidents of joint use involving sludge. Assessment of the existence of a joint-use problem, however, was hindered somewhat by a lack of comprehensive data for this unique subset of transportation incidents.

The basic approach for assessing the scope of available protection and any gaps that may exist was to review current regulatory requirements and industry practices. The study did not attempt to assess the extent of any noncompliance with current statutory and regulatory requirements regarding transportation of hazardous materials. In evaluating the level of protection provided, the study focused on three scenarios that are most likely to result in contamination of nonhazardous goods during transportation: (1) residue remaining after a bulk shipment of a hazardous material causing contamination of a subsequent bulk shipment of a nonhazardous good in the same vehicle; (2) a spill during packaged (i.e., containerized) shipment of a hazardous material causing contamination of a subsequent packaged shipment of a nonhazardous material; and (3) a spill during simultaneous shipment of packages of a hazardous material and packages of a nonhazardous material.

1.4 REPORT ORGANIZATION

The remainder of this report is organized as follows:

- Chapter 2 provides available information on the nature and scope of the joint use problem.

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[2]Definitions of terms used in this report are included in a glossary appended to this report.

- Chapter 3 reviews and summarizes the regulatory requirements for shippers, carriers, and receivers of hazardous materials and identifies regulatory gaps. It also provides an analysis of sequential bulk shipment of hazardous waste and sewage sludge.

- Chapter 4 analyzes current industry standards and practices.

- Chapter 5 summarizes the results of the study and provides appropriate conclusions and recommendations to Congress.

1.5 ACKNOWLEDGEMENT

This EPA Report to Congress was prepared in full consultation with the Secretary of Transportation and with DOT's Office of Hazardous Materials Transportation. EPA gratefully acknowledges the close cooperation and substantial contribution made by the Transportation Systems Center throughout the study and during preparation of this report.

CHAPTER 2

ANALYSIS OF THE JOINT USE OF VEHICLES PROBLEM

An accurate analysis of the problems that may arise as a result of the joint use of vehicles requires that the basic constituents of the problem be identified and defined. The joint use of vehicles, for purposes of this study, refers to the simultaneous or sequential use of a motor vehicle, such as a truck or rail car, to transport: (1) hazardous contaminants; and (2) nonhazardous goods, such as food or fibers. The specific problem targeted for study is the incidence of contamination of a nonhazardous good by a hazardous contaminant.

The analysis of the joint use of vehicles problem requires the examination of four elements. The analysis begins with a determination of the quantity of hazardous contaminants transported annually in the United States, and how these quantities are divided among the various modes of transportation. Secondly, the history, to the extent available, of joint-use incidents is investigated in order to place the problem in perspective. The third element in the analysis is an illustration of the potential problem, which includes a categorization of hazardous contaminants and the nonhazardous goods they may contaminate. The fourth element of the analysis is the development of scenarios that illustrate the potential for harm to human health and the environment. These scenarios were extrapolated, in part, from information provided in Sections 2.1, 2.2, and 2.3 of this chapter. The scenarios are for illustrative and for discussion purposes only and do not address the probability of an actual occurrence.

2.1 HAZARDOUS MATERIALS TRANSPORTATION

National statistics on hazardous materials[1] transportation are presented in Exhibit 2-1. Approximately 1.5 billion tons of hazardous materials were transported by aircraft, watercraft, truck, and rail car in 1982, the most recent year for which statistics are available.

Because the number of shipments, and not the length of the haul, determines the opportunity for joint-use contamination, each transportation mode's share of tons, rather than the product of tons and miles transported, is presented in Exhibit 2-1. Possibilities for joint-use contamination exist

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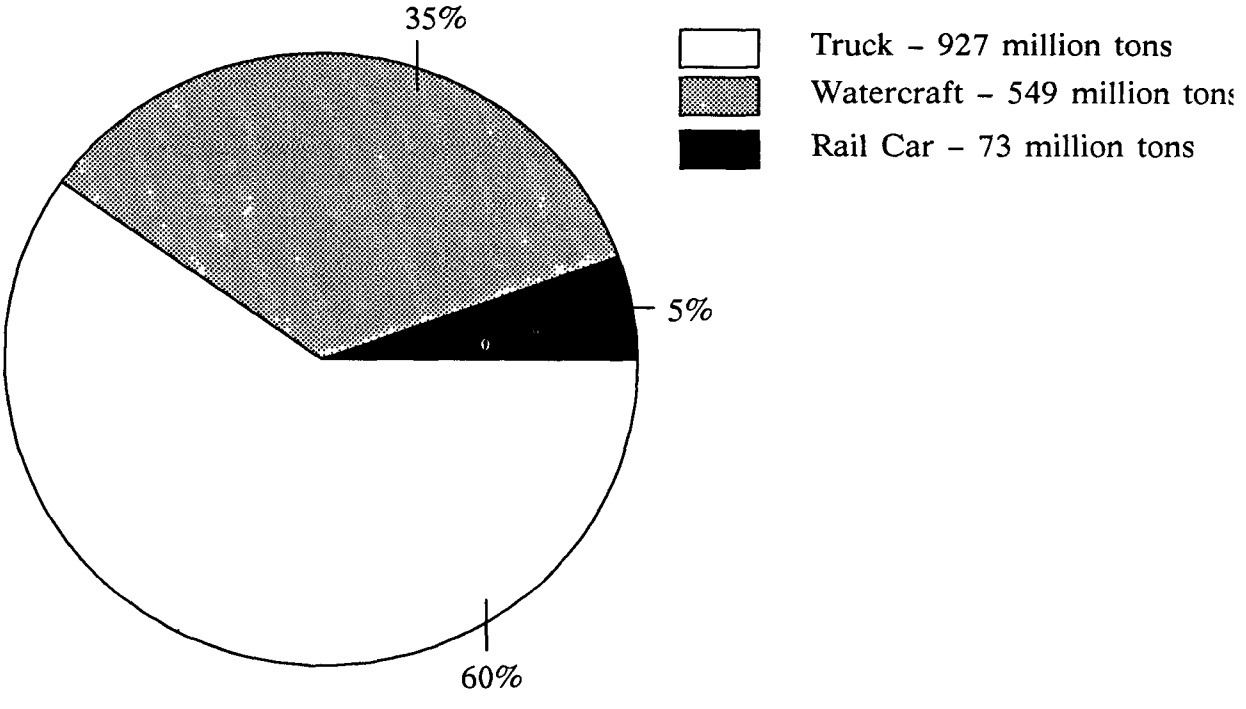
[1]The statistics presented in this section were prepared by the U.S. Department of Transportation, the U.S. Department of Commerce, the Office of Technology Assessment, and the Federal Railroad Administration, and reflect transportation of hazardous materials as defined in 49 CFR §171. Hazardous materials also include CERCLA hazardous substances (which include radionuclides and RCRA hazardous wastes), but not all conceivable hazardous contaminants. The Agency believes, however, that these statistics fairly describe the overall situation.

Exhibit 2-1

Hazardous Materials Transportation in the United States by Mode (1982)



Note: Aircraft transported 0.3 million tons of hazardous material in 1982. This accounts for less than 0.02% of the total.

Source: George List and Mark Abkowitz, "Estimates of Hazardous Material Flow Patterns" *Transportation Quarterly*, Vol. 40, No. 4 (October 1986) 483-502.

for every mode of transportation, including aircraft, watercraft, truck, and rail car. SARA Section 118(j), however, requires a "study of problems associated with the use of any vehicle for purposes other than the transportation of hazardous substances when that vehicle is used at other times for the transportation of hazardous substances" [emphasis added]. Additionally, CERCLA defines "vessel" as any watercraft and distinguishes these from "facility," which includes vehicles such as trucks and rail cars (40 CFR §302.3). For these reasons, only transportation by truck and rail car are addressed here (air transportation of hazardous materials accounts for only a small fraction, less than 0.02 percent, of the total, and is not considered in this study).

2.1.1 Transportation by Truck

Exhibit 2-2 illustrates that only a small proportion of the truck population (3 percent) was used for the transportation of hazardous materials in 1982. Many of the trucks used in hazardous materials transportation are not used exclusively for this purpose. Exhibit 2-3 relates the number of trucks used for hazardous materials transportation to the percentage of time they were used for this purpose. Because these statistics reflect the use of a tractor in combination vehicles, they tend to understate, to an unknown degree, the proportion of the time an accompanying trailer is involved in hazardous materials transportation. The statistics shown in Exhibit 2-3 are important to the joint-use study because they illustrate the large proportion of trucks used for hazardous materials transportation and, at other times, for nonhazardous goods transportation.

The types of trucks involved in hazardous materials transportation are identified in Exhibit 2-4.[2] The most common truck type used for this purpose is the enclosed van. These vehicles generally are not used for bulk shipments, but rather in shipment of packaged hazardous materials. Because approximately 70 percent of all trucks hauling hazardous materials carry package shipments, DOT regulations that require cleaning of spills from packages cover most hazardous materials shipments. The only truck types commonly used for bulk shipments of hazardous materials are tank trucks (dry and liquid), dump trucks, grain body trucks, and cargo container chassis trucks.

Exhibit 2-5 segregates trucks that carry hazardous materials according to the major products carried. The exhibit indicates that the largest percentage of trucks in hazardous materials service carry petroleum products, mixed cargo, and chemicals. These trucks account for two-thirds of all trucks in hazardous materials service. Vehicles used by craftsmen and trucks used to haul mixed cargo, processed foods, machinery, and fabricated metal products would not be expected to haul bulk cargo. The majority of trucks hauling petroleum products are dedicated tank trucks, and would not be expected to contribute to a joint-use problem. Those remaining, however, represent about one-third of the fleet subject to the possibility of joint-use contamination.

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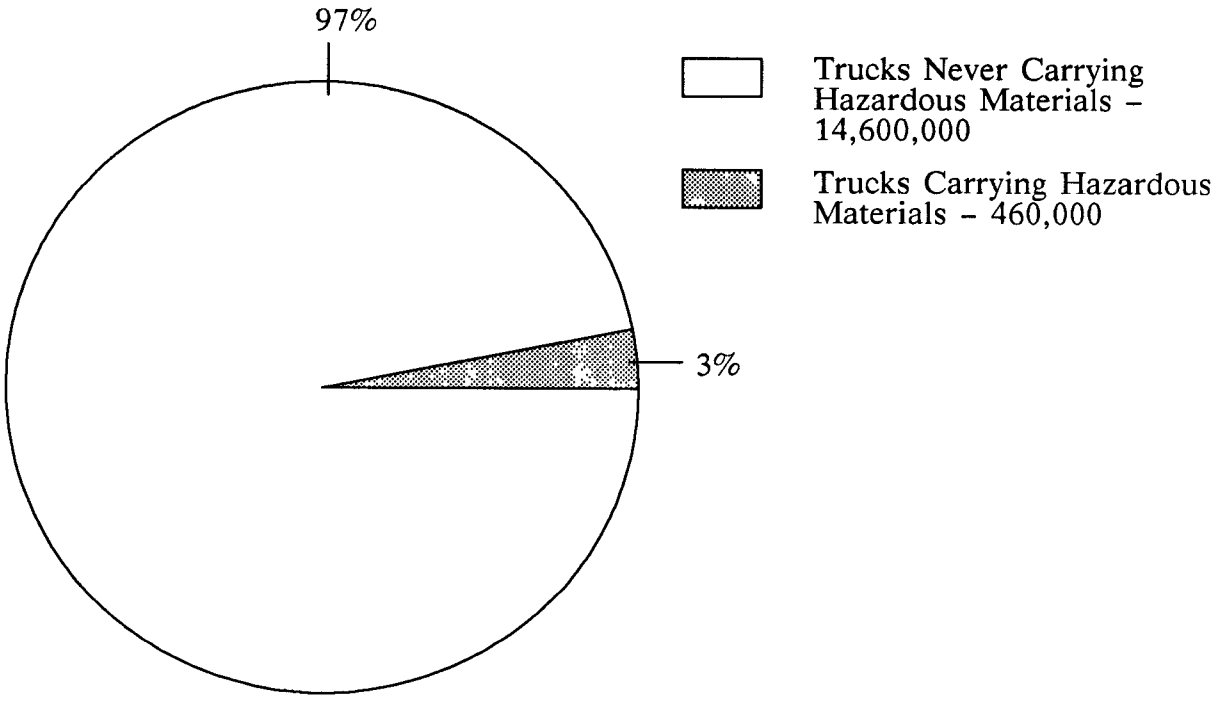
[2]See the Glossary for descriptions and Appendix C for illustrations of the trucks listed in Exhibit 2-4.

Exhibit 2–2

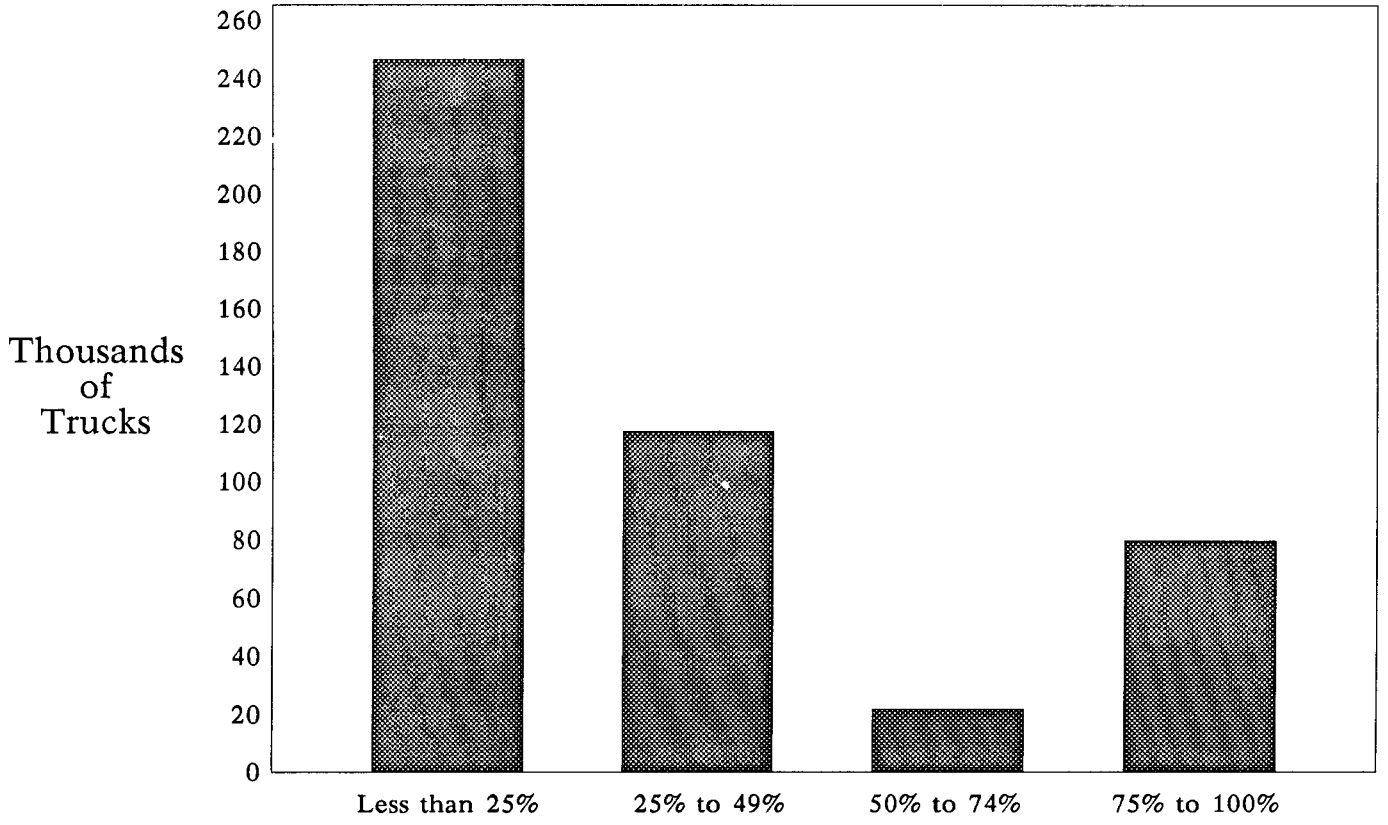
Number of Trucks Carrying Hazardous and Nonhazardous Materials (1982)



Source: 1982 Census of Transportation, Truck Inventory and Use Survey, U.S. Department of Commerce, Bureau of the Census, September, 1985.

Exhibit 2–3

Percentage of Time Trucks are in Hazardous Materials Service



Source: 1982 Census of Transportation, Truck Inventory and Use Survey, U.S. Department of Commerce, Bureau of the Census, September, 1985.

EXHIBIT 2-4

Types of Trucks in Hazardous Materials Service (1982)

Truck Type*	No. of Trucks (thousands)	% of Trucks	Cumulative %	Bulk 'B' Package 'P'
Basic Enclosed Van	140.6	30.47	30.47	P
Tank Truck	129.9	28.15	58.63	B
Pick-up	88.9	19.27	77.89	P
Platform Type	45.4	9.84	87.73	P
Insulated Nonrefrigerated Van	9.8	2.12	89.86	P
Panel or Van	7.8	1.69	91.55	P
Oilfield Truck	7.8	1.69	93.24	P
Dump Truck	4.0	0.87	94.10	B
Multistop/Walk in	4.1	0.89	94.99	P
Insulated Refrigerated Van	3.7	0.80	95.80	P
Tank Truck (Dry Bulk)	2.8	0.61	96.40	B
Service Truck	2.8	0.61	97.01	P
Public Utility	1.6	0.35	97.36	P
Grain Body	1.3	0.28	97.64	B
Low Boy/Depressed Center	1.1	0.24	97.88	P
Drop-frame Van	0.9	0.20	98.07	P
Open-top Van	0.8	0.17	98.24	P
Cargo Container Chassis	0.8	0.17	98.42	B
Winch/Crane	0.5	0.11	98.53	P
Beverage	0.3	0.07	98.59	P
Other	6.5	1.41	100.00	P
TOTAL	461.4	100.00		

*See the Glossary for descriptions and Appendix C for illustrations of representative truck types.

SOURCE: 1982 Census of Transportation, Truck Inventory and Survey, U.S. Department of Commerce, Bureau of the Census, September, 1985.

EXHIBIT 2-5

Trucks in Hazardous Materials Service Segregated by Principal Product Carried (1982)

Product Type	No. of Trucks (thousands)	% of Trucks
Petroleum	136.7	29.63
Mixed Cargo	113.6	24.62
Chemical	60.1	13.03
Processed Foods	12.1	2.62
Machinery	8.4	1.82
Craftsmens' Vehicles	32.2	6.98
Agriculture	14.0	3.03
Fabricated Metal	6.9	1.50
Scrap/Refuse	6.9	1.50
Other	70.5	15.28
TOTAL	461.4	100.00

SOURCE: 1982 Census of Transportation, Truck Inventory and Use Survey, U.S. Department of Commerce, Bureau of the Census, September, 1985.

2.1.2 Transportation By Rail

Significant quantities (73 million tons in 1983) of hazardous materials are transported by rail. As shown in Exhibit 2-6, the largest quantities transported are flammable liquids (e.g., petroleum products) and corrosive materials (e.g., sulfuric acid). Smaller amounts of liquified nonflammable gases and flammable compressed gases are also carried. Only a very small fraction of the total transported was represented by Poison B (3 percent), Poison A (0.1 percent), and radioactive material (0.01 percent).[3] Considering the total tonnage, however, this represents a significant amount in terms of quantity and number of shipments.

The majority of hazardous materials transported by rail in 1983 was carried by tank car. Other types of cars, including box cars, refrigerator cars, hoppers and gondolas, together haul only 10 percent of hazardous materials carried by rail, as shown in Exhibit 2-7. Exhibit 2-8 illustrates that chemicals and petroleum products make up the vast majority of hazardous materials transported by rail, comprising 68 percent and 23 percent, respectively, of the total.

2.1.3 Summary

Huge quantities of hazardous materials are transported in the United States every year. Although the statistics presented here do not address the joint-use problem, it is clear that the potential for joint-use contamination exists. This potential will be examined further in the remaining sections of this chapter, while regulations addressing the transport of hazardous materials will be discussed in Chapter 3.

2.2 ILLUSTRATIVE HISTORICAL INCIDENTS OF JOINT-USE CONTAMINATION

An examination of historical information concerning joint-use contamination incidents will identify, and place in perspective, some of the problems likely to arise when vehicles are used to transport both hazardous contaminants and nonhazardous goods. To this end, an effort was made to compile historical incidents that document, to varying degrees, contamination of nonhazardous goods which occurred as a result of joint use of a transportation vehicle. Generally, contamination of nonhazardous goods in a vehicle that has been used to transport hazardous contaminants may arise in three particular ways: (1) residue remaining after a bulk shipment of a hazardous contaminant causing contamination of a subsequent bulk shipment of a hazardous or nonhazardous good in the same vehicle; (2) a spill during package (i.e., containerized) shipment of a hazardous contaminant causing contamination of a subsequent package shipment of a hazardous or nonhazardous good; and (3) a spill during a simultaneous shipment of packages of a hazardous contaminant and packages of a nonhazardous good.

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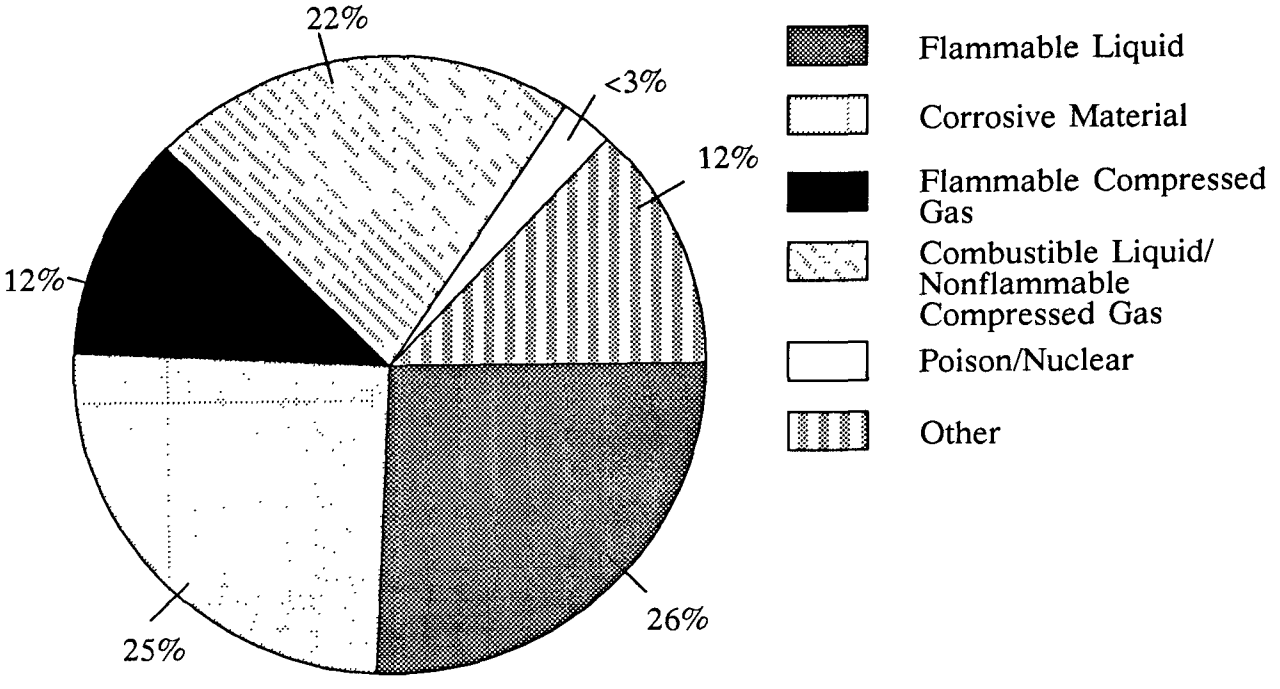
[3]See Exhibit 3-2 for definitions of Poison B, Poison A, and radioactive material.

Exhibit 2–6

Hazardous Material Transported by Rail by Hazard Class (1983)



Source: U.S. Congress, Office of Technology Assessment, *Transportation of Hazardous Materials,* OTA–SET–304 (Washington, D.C.: U.S. Government Printing Office, July, 1986).

EXHIBIT 2-7

Rail Transport of Hazardous Material Segregated by Car Type

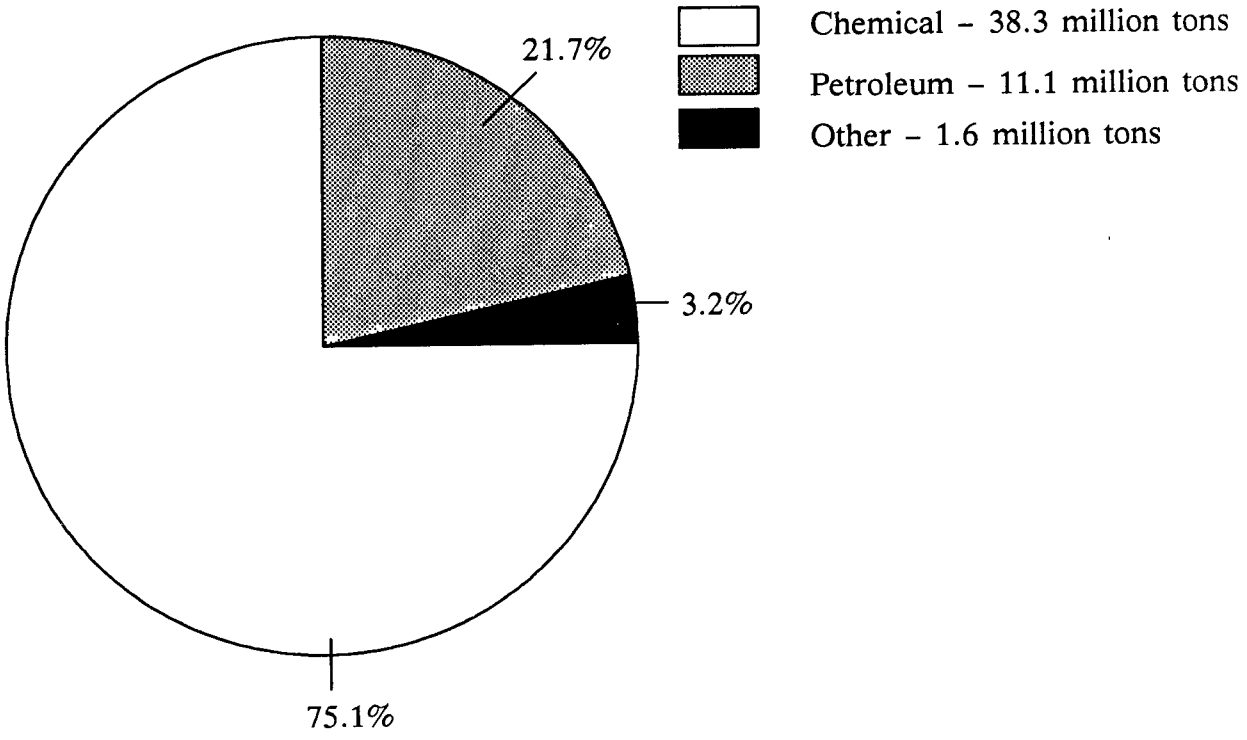
Car Type	Tons Carried	Percent of Total
Tank	45,853,875	89.8
Hopper and Gondola	2,961,792	5.7
Flat	1,311,842	2.6
Box and Refrigerator	650,061	1.3
Other	304,505	0.6
TOTAL	51,082,075*	100.0

*This total was developed under the Standard Transportation Commodity Code-49 (STCC). This method differs from the methods of List and Abkowitz (Exhibit 2-1) and the Office of Technology Assessment (Exhibit 2-6) and leads to a somewhat smaller total.

SOURCE: 1983 Carload Waybill Statistics, Report TD-1. Federal Railroad Administration, Washington, D.C. April, 1986.

Exhibit 2-8

Hazardous Material Transported by Rail, by Commodity (1983)



Source: 1983 Carload Waybill Statistics, Report TD-1. Federal Railroad Administration, Washington, D.C. April, 1986.

Specifically, this section includes 18 documented incidents and five anecdotal incidents of joint-use contamination. Section 2.2.1 abstracts four cases that are well documented, and Exhibit 2-9 presents 14 other documented cases in tabular form. Section 2.2.2 discusses five cases that have not been thoroughly documented; however, the source or sources of this information serve as grounds for a reasonable inference that these reports represent actual occurrences of contamination. These documented and anecdotal incidents of joint-use contamination are primarily for illustrative purposes, and do not necessarily reflect all contamination incidents, documented or undocumented, within the time period in which the incidents presented in this section have occurred. The historical incidents discussed in this section, however, are representative of the manner in which contamination could occur, the types of nonhazardous goods that could be contaminated, and the nature and type of the hazardous contaminants themselves.

Significant limitations to gathering data on the history of joint-use contamination have become evident. One limitation is the absence of comprehensive data to identify joint-use incidents. EPA, DOT, and other agencies have information on hazardous contaminant transportation incidents because certain releases of hazardous materials and hazardous substances must be reported to various authorities. For example, DOT regulations require the submission of a carrier report, in writing, if during transportation, a hazardous material is unintentionally released from a packaging or any quantity of hazardous waste is discharged (49 CFR §171.16(a)). A carrier is also required to notify DOT by telephone if, as a result of the release of a hazardous material (including a hazardous waste), a person is killed or hospitalized, property damage exceeds $50,000, spillage or suspected contamination occurs involving shipments of radioactive material or etiologic agents, or an incident occurs comparable in seriousness to those mentioned above (49 CFR §171.15).[4] However, this incident data base is neither designed nor organized to be accessible in a manner conducive to the data needs of this joint-use study. Particularly, in most cases, it appears that the release is what will trigger a reporting requirement; the regulations do not initially focus on the contamination, if any, that may have resulted. Moreover, usually only those contamination incidents that produced a very significant result, such as death, serious injury, or extreme property damage, will be documented such that the data can be readily accessed at a later time.

The methodology used to ascertain the historical data discussed in Sections 2.2.1 and 2.2.2 of this chapter involved the use of a survey approach. Contact was initiated with personnel at Federal and State agencies and in private industry who were believed to be in a position to possess, or know of potential sources for information on incidents of joint-use contamination. Federal agency contacts included personnel at DOT, EPA, the Food and Drug Administration, the Centers for Disease Control, and the Office

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[4]DOT and EPA regulations relating to reporting and other requirements involved in the transportation of hazardous materials and wastes are discussed in greater detail in Chapter 3.

of Technology Assessment. State environmental, health, transportation, and diagnostic toxicology personnel were also resources for the data discussed in this chapter. Private industry contacts, such as personnel at trucking companies, associations, and chemical manufacturers provided some assistance in the research effort. The aforementioned personal and telephone contacts produced both documented and anecdotal incidents for use in this chapter. Appendix B contains a list of those organizations and people contacted to obtain information for this study.

2.2.1 Documented Incidents of Joint-Use Contamination

Case 1.[5] On August 19, 1968, several individuals in the Houston, Texas area experienced an outbreak of intestinal upset with associated salivation, perspiration, cough, and coma. The first victim, a 53-year-old man, became ill four hours after eating his usual dinner at home. He was admitted to the county hospital in a semicomatose state. Later that same evening his 10-year-old daughter and 27-year-old son were admitted to the hospital with similar symptoms. An aunt and uncle, who came from a nearby city to render assistance, also became ill after eating at the family home. All leftover food was thrown into a chicken coop behind the house and eight chickens, a dog, and a cat died the following day.

The patients, on recovery, denied having any contact with pesticides. Clinical interpretation of signs and symptoms, however, suggested acute organic phosphate poisoning. Although no pesticide was positively demonstrated to be present in the blood of the hospitalized patients, clinical diagnosis was confirmed by other laboratory tests as acute organic phosphate poisoning.

The source of the human illness and animal deaths was traced to consumption of homemade tortillas, which contained flour, baking powder, lard, and salt; only the flour had not been used in the preparation of other meals. The family had recently purchased the flour in a torn 100-pound paper sack. Samples of the flour were shown by gas liquid partition chromatography to contain more than 300 parts per million of carbophenothion, a hazardous material and organophosphorus pesticide.

After the flour was packaged by the miller, it was stored in a warehouse and then shipped by railroad car before reaching the retail outlet. A second sack from this same outlet showed evidence of a stain on the bag, which was also determined to be carbophenothion. Although no conclusive evidence of a spill or contamination could be found in the warehouse or railroad car, one of these two locations was suspected as the place where the contamination event occurred.

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[5]Older, J.J., and Hatcher, R.L. "Food Poisoning Caused by Carbophenothion," J.A.M.A., 209:1328-1330 (1969).

Case 2.[6] On March 29, 1964, a 5-year-old boy was admitted to Lions Gate Hospital in Vancouver, British Columbia, semicomatose and in respiratory distress. The history indicated that on March 27 he did not feel well and vomited two or three times. On the morning of admission he complained of sore eyes and blurred vision and appeared somewhat confused. The child subsequently became deeply comatose and respiration was maintained artificially. That evening the patient's condition suddenly and inexplicably began to improve. The child's condition continued to improve and he was discharged from the hospital on April 9.

On April 7, a 12-year-old boy, who was a neighbor of the 5-year-old, was admitted to the hospital with practically identical symptoms. His illness followed the same course as that of the 5-year-old, becoming worse, then, inexplicably, improving. The 12-year-old boy was discharged on April 18.

On April 11, the 5-year-old boy was readmitted to the hospital with the same symptoms as had been observed on March 29. His illness followed the same course as the last onset of the symptoms, leading to a deep coma and severe respiratory difficulty. These symptoms seemed typical of anticholinesterase poisoning produced by organophosphorus pesticides, but no history of exposure was evident.

On April 13, an older brother of the 5-year-old, who was in bed, complained that he had a headache. A brown stain was observed on a flannelette sheet; flannelette sheets had been used by several members of both families. The onset of symptoms appeared to be in the morning, after awakening, and disappeared once contact with the sheets was discontinued; therefore, the flannelette sheets were suspected as the source of the illness. The brown stain on the sheet was ultimately analyzed as parathion, an organophosphorus pesticide. Fortunately, efforts to recover other contaminated sheets to prevent additional human reactions to the contaminant were successful.

Investigation indicated that the sheets had been loaded at Antwerp, Belgium, on a German freighter and off-loaded in Vancouver on February 5, 1964. Further investigation revealed that the German freighter had also carried 72 55-gallon drums of parathion in the same hold as the flannelette sheets. The drums of parathion had been unloaded in California before the ship reached Vancouver. A thorough investigation was initiated in British Columbia and California in order to determine if any other goods had been contaminated. As a result of this investigation, some silk and a number of contaminated baby blankets were found and destroyed.

The contamination in this case probably occurred in the hold of the German vessel. Although the scope of this joint-use study does not extend to

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[6]Anderson, L.S., Warner, D.L., Parker, J.E., Bluman, N., and Page, B.D., "Parathion Poisoning From Flannelette Sheets," Can. Med. Assoc. J., 92:809-813 (1965).

vessels, this incident is significant by analogy. Further, the insidious nature of the contamination that resulted from the mixed load in the hold of the German freighter is likely to be observed in any joint-use contamination incident regardless of the mode of transportation involved.

Case 3.[7] An 8-year-old Fresno, California, boy was diagnosed on October 4, 1961, as suffering from organic phosphate poisoning. His illness, which had developed at school, was evidenced by rapid pulse and respiration, pallor, and a "glassy stare." He later developed muscle twitches, diarrhea, abdominal pain, and vomiting. The public health department was unable to find the source of the poisoning. Several days after discharge from the hospital, the boy's symptoms returned while he was riding in the family car. As a consequence, the search for a cause was limited to the contents of the car and the clothing common to the two episodes. A stain on the boy's blue jeans, and the symptoms and diagnosis, indicated that the jeans should be tested for a pesticide contaminant. Testing demonstrated that exposure of adult mosquitoes to the jeans resulted in the death of the mosquito colonies.

A few days later, another boy was admitted to the hospital in a comatose state. This boy also had been wearing unwashed new blue jeans. Testing of his clothes revealed that adult mosquito colonies were killed when exposed to the blue jeans.

Both pairs of blue jeans were traced to a damaged goods outlet of a local trucking firm. A warning was issued to alert the public to the blue jean contamination, and in response, all the contaminated clothes were recovered.

An investigation by the health department revealed that approximately eight months prior to the aforementioned incidents, these pants had been shipped 225 miles on a truck that also carried 120 gallons of phosdrin, an organophosphate pesticide. Apparently, phosdrin had spilled in the truck and contaminated the pants: the recipients of the goods had filed claims, one for the loss of one and one-eighth gallons of phosdrin, and the other for stain damage to 16 pairs of blue jeans.

Case 4.[8] During the afternoon of May 2, 1956, 10 men working in a factory northeast of Swansea in Wales fell violently ill. Emissions from the factory were at first suspected as the cause of the illness, but were later eliminated from suspicion due to the widespread incidence of the disease. The following day 47 additional cases with similar symptoms were identified. In all, 59 people sought medical treatment, and it was estimated that an additional 100 individuals were affected but did not seek medical help.

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[7]Warren, M.C., Conrad, J.C., Bocian, J.J., and Hayes, M., "Clothing Borne Epidemic. Organic Phosphate Poisoning in Children," J.A.M.A., 184:266-268 (1963).

[8]Davies, G.M., and Lewis, I., "Outbreak of Food Poisoning from Bread Made of Chemically Contaminated Flour," Br. Med. J., 2:393-398 (1956).

Research indicated that all of the victims had consumed a bread product produced at a local bakery.

Further investigation revealed that the baker had returned two sacks of flour to his supplier because the flour had an unusual odor. Apparently, however, additional sacks had been contaminated and used in the preparation of bread. An announcement was made on the radio advising the local population to destroy any bread purchased from the suspect bakery. In at least one case, however, the bread was fed to 12 chickens, all of whom died.

The two sacks of flour the baker had returned to his supplier were traced to a warehouse in Swansea and were found to have an aromatic odor at the bottom of the sack. Analysis of the sacking and the immediately adjacent flour indicated contamination by endrin, a halogenated insecticide, which is a central nervous system stimulant. Shipping invoices were used to trace the history of the shipment containing these two sacks of flour. It was found that they were loaded on a rail car in Cardiff, Wales, on April 21, unloaded at Swansea on the 25th of April, and immediately delivered to the baker along with other sacks.

Further inquiry involving several parties indicated that endrin had been transported and spilled in the rail car on February 20th of the year in which the incident was reported. The spill involved an unspecified quantity of endrin as a concentrated (800 to 1600 times more concentrated than used for spraying) solution in xylene. Scrapings from the floor of the car showed a concentration of 116,000 parts per million of endrin.

Summary of Cases

The four cases discussed above exemplify the means by which a hazardous contaminant may contact a nonhazardous good, the types of nonhazardous goods that are vulnerable to contamination, and the hazardous contaminants that may be responsible for the contamination and the resultant harm. Specifically, Case 1 shows that a nonhazardous good (flour) in a sack, in either a railcar or warehouse, could be contaminated by a hazardous contaminant (carbophenothion) and cause serious illness in humans as well as deaths of animals. Case 2 demonstrates that sheets stored in the same compartment as parathion on a transport vessel could be subject to contamination and cause serious illness. Case 3 illustrates that an article of clothing when shipped on a truck carrying a hazardous contaminant (phosdrin) is susceptible to contamination that can cause significant health effects. Case 4 emphasizes the seriousness and widespread health effects, including severe human illness and animal deaths, of contamination of an edible good (flour) that had been contaminated by a halogenated insecticide (endrin), which had been spilled in the same railcar that was used to transport the flour.

For the sake of brevity, Exhibit 2-9 presents in tabular form 14 additional cases of joint-use contamination.

EXHIBIT 2-9

Additional Documented Cases of Contamination Occurring During Transport or Storage

Contaminant Involved	Material Contaminated	No. of Injuries	No. of Deaths	Location	Year
PCBs	Oats	0	0	USA	1982
Freon	Propane	76	0	USA	1986
Lead Oxide	Corn Gluten	24 (dogs)	24 (dogs)	USA	1974
Endrin	Flour	3	0	Egypt	1967
Endrin	Flour	691	24	Qatar	1967
Endrin	Flour	183	2	Saudi Arabia	1967
Dieldrin	Food	21	0	Shipboard	1962
Diazinon	Doughnut Mix	20	0	USA	1965
Parathion	Wheat	360	102	India	1958
Parathion	Barley	38	9	Malaya	1960
Parathion	Flour	200	8	Egypt	1958
Parathion	Flour	26	0	Yugoslavia	1961
Parathion	Flour	600	88	Columbia	1967
Parathion	Flour and Sugar	559	16	Mexico	1968

Sources:

PCBs: Neil Ross, Environmental Conservation Officer, New York State Department of Environmental Conservation, Arresting Officer on November 4, 1982 in Gasport, New York.

Freon: EPA Region IX file dated February 10, 1986.

Lead Oxide: United States vs. Penn Central Transportation Co. and CPC International, Inc., No. 78-10008 (S.D. Ill 1978).

Endrin, Dieldrin, Diazinon, and Parathion: Hayes, W.J., "Toxicology of Pesticides," The Williams and Wilkins Co., Baltimore, 1975.

2.2.2 Anecdotal Incidents of Joint Use Contamination

In the course of the Agency's investigation of joint-use contamination incidents, individuals in Federal and State government and private concerns related joint-use contamination incidents that they knew of although they did not have any documentation on them. Five of these incidents are reported below.

Case 1.[9] This source indicates that sometime in 1984 or 1985, a truck in the State of Idaho was carrying both meat and a pesticide. A leak in a container of pesticide allowed the pesticide to contaminate the meat. The source had no knowledge of whether or not deaths or injuries occurred in this case.

Case 2.[10] This source relates a 1974 incident involving a liquid tank truck used to haul a liquid fertilizer (possibly a solution of ammonium nitrate) and subsequently used to haul potable water. The water was placed in field tanks for cattle, several of which died from drinking this water.

Case 3.[11] This source indicates that propane is occasionally contaminated with anhydrous ammonia. Both substances are gases at standard temperature and pressure and are usually stored and transported as liquids under pressure. In rural areas propane is used as a fuel for space heating, water heating, and cooking while ammonia is used as a fertilizer. The greatest demand for propane is in the winter, while ammonia is in most demand in the summer. The vessels needed to transport these liquids are identical. Because seasonal use for propane and ammonia is complementary, the same trucks are often used for hauling both commodities at different times. If a truck used for hauling ammonia is not properly cleaned before returning it to propane service, contamination will occur.

Case 4.[12] This source identified a contamination incident that occurred in Grand Rapids, Michigan, in the fall of 1986. Thousands of yards of cloth destined for the manufacture of baby clothes were contaminated with Dinoseb, a nitrophenol insecticide. A yellow stain caused by the Dinoseb was sufficiently noticeable that the yard goods were rejected by the receiver. The carrier was found to have transported Dinoseb in the same truck on an earlier date and failed to clean the truck properly.

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[9]Edith Page, Office of Technology Assessment, Washington, D.C. Telephone interview, January 20, 1987.

[10]Dr. Frank Ross, National Veterinary Services Laboratory, Food and Drug Administration, Ames, IA. Telephone interview, January 29, 1987.

[11]Ron DeNoville, Crawford and Co. (a private risk management service). Telephone interview, January 28, 1987.

[12]Bob Mesecher, Michigan Department of Agriculture, Pesticide and Plant Pest Management Division, Lansing, MI. Telephone interview, February 4, 1987.

Case 5.[13] This source reported an incident that occurred recently at a bubble gum factory in Hastings, Michigan (date unavailable). While unloading molten wax used in bubble gum preparation from a tank truck, the manager noted an unusual odor. Because of this odor, the wax was not used in the manufacture of the bubble gum. Subsequent investigation revealed that the trucker's previous shipment was dichloroaniline. Analysis indicated significant levels of dichloroaniline in the wax.

2.3 ILLUSTRATION OF THE POTENTIAL PROBLEM

In addition to the examination of the extent of hazardous material transportation and the history of joint-use contamination, the third element that is necessary in an analysis of the joint-use problem is an evaluation of the potential hazards involved in joint use of vehicles. One method for illustrating potential hazard to the public health and the environment resulting from joint use of vehicles is to estimate the extent of hazard for each hazardous contaminant combined with each transported nonhazardous good. The set of the hazards estimated in this way indicates the possible levels of hazard for each situation. If this level of hazard coupled with the estimated frequency of occurrence is determined to be unreasonable, then regulation or some other mechanism to reduce the hazard to an acceptable level may be warranted.

The possible combinations of hazardous contaminants and nonhazardous goods are far too numerous to deal with effectively. In order to permit meaningful discussion and some appreciation of the potential hazard associated with the joint use of vehicles, some manageable aggregation of the possible combinations must be developed. Hazardous contaminants and the nonhazardous goods they could feasibly contaminate must be categorized into manageable groups. This section is divided into four major parts. The first, Section 2.3.1, describes the method used in this report for categorizing hazardous contaminants into manageable groups that might be used for hazard assessment. Section 2.3.2 describes the method chosen for categorizing nonhazardous goods into groups that might be affected by hazardous contaminants concurrently or previously hauled in a truck or rail car. In Section 2.3.3, a matrix is developed as a general guide for illustrating the relative hazards resulting from contamination of nonhazardous goods by hazardous contaminants. In Section 2.3.4, various contamination scenarios are analyzed and their potential to affect public health and the environment is discussed.

2.3.1 Categorization of Hazardous Contaminants

The number and variety of potential hazardous contaminants is very large.[14] Potential hazardous contaminants can, among other things, be acute

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[13]Dr. Brazelton, Chief, Analytic Toxicology Laboratory, Michigan State University, Lansing, MI. Telephone interview, January 30, 1987.

[14]There are 717 CERCLA hazardous substances alone. This study contemplates the entire universe of hazardous contaminants, which is probably several times larger.

or chronic toxicants, potential carcinogens, mutagens, or flammable materials. They can be solids, liquids, or gases, or found in solution. The Agency, for the purposes of this report, categorizes hazardous contaminants according to a variety of their properties.

Each hazardous contaminant may be ranked and classified relative to other contaminants; that is, as being less hazardous, approximately equally hazardous, or more hazardous than another hazardous contaminant. If, for example, in comparing two hazardous contaminants, the measure of hazard is ignitability, the hazardous contaminant with the lower flash point might be considered the more hazardous contaminant. This comparison becomes much more difficult when more than one property of a group of hazardous contaminants must be used to produce a list of relative hazards. One of several possible approaches to this problem is exemplified in the determination of reportable quantities (RQs) for the current list of 717 CERCLA hazardous substances.

Sections 103(a) and 103(b) of CERCLA require that persons in charge of vessels or facilities from which hazardous substances have been released in quantities that are equal to or greater than the RQ immediately notify the National Response Center[15] of the release. Notification based on RQs serves as a trigger for informing the government of a release so that the need for a response can be evaluated. The RQs do not reflect nor imply a determination that a release of a hazardous substance will be hazardous at or above the RQ level and not hazardous below that level. EPA has not attempted to make such a determination, because the actual hazard will depend on the particular circumstances of each release (50 FR 13465). Federal personnel will evaluate all reported releases of an RQ or more, although the government will not necessarily respond to all these releases with a CERCLA-funded removal or remedial action.

The RQ adjustment methodology is based upon six primary criteria: (1) aquatic toxicity; (2) mammalian toxicity (oral, dermal, and inhalation); (3) ignitability; (4) reactivity; (5) chronic toxicity; and (6) potential carcinogenicity. The Agency ranks each intrinsic property on a five-tier scale (50 FR 13467-8) (with the exception of potential carcinogens for which the Agency has proposed to use a three-tier scale and radionuclides, for which a 7-tier scale has been proposed), associating a specified range of values on each scale with a particular RQ value and RQ category. Thus, each hazardous substance receives several tentative RQ values based on its particular properties. The primary criteria RQ for each hazardous substance is the lowest value from the applicable primary criteria. A five-tier rating scale has been set up corresponding with RQ values of 1, 10, 100, 1000, and 5000 pounds (also known as RQ categories X, A, B, C, and D, respectively).

The methodology used to assign RQs is neither a risk assessment nor an absolute measure of potential harm. It is simply a method for sorting a list of hazardous substances into levels of relative hazard, which may be equated

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[15]The toll-free telephone number of the National Response Center is 1-800/424-8802; in the Washington, D.C. metropolitan area the number is 1-202/426-2675.

to RQ levels for notification purposes. These RQ categories, with or without modification, can also be used to categorize hazardous contaminants for purposes of the joint-use study. Of the current list of 717 CERCLA hazardous substances, 442 have final adjusted RQs and 273 have proposed adjusted RQs. The two remaining substances (lead and methyl isocyanate) retain their statutory one-pound RQ until completion of analysis.

The five RQ categories X, A, B, C, and D are used, with certain modifications, to categorize hazardous contaminants in this study. First, hazardous substances falling into RQ Category X will be placed in hazardous contaminant Category 1, those in RQ Category A in Category 2, those in RQ Category B in Category 3, and those in RQ Categories C and D in Category 4. Those hazardous substances in RQ Categories C and D have been placed together in hazardous contaminant Category 4 because the Agency believes that, for the purposes of this study, the hazard associated with hazardous substances having RQs of 1000 and 5000 pounds is relatively low and nearly identical. In addition, DOT hazardous materials that do not exhibit a toxic or carcinogenic effect (e.g., nonflammable compressed gases) will also be placed in hazardous contaminant Category 4.

Second, for purposes of placing any hazardous substance into hazardous contaminant category 1, 2, 3, or 4, only those RQ criteria that result in some toxic effect (i.e., aquatic toxicity, mammalian toxicity, chronic toxicity, and potential carcinogenicity) will be used. Even though many RQs are based on ignitability or reactivity, a primary criteria RQ for at least one of the toxic effect criteria is available for the 715 hazardous substances whose RQs have been adjusted or proposed to be adjusted, and will be used for assignment to hazardous contaminant categories.

Third, those hazardous contaminants that are neither hazardous substances, hazardous materials, nor hazardous wastes will be assigned to a hazardous contaminant category based on the results of tests for aquatic toxicity, mammalian toxicity, chronic toxicity and potential carcinogenicity, performed in the manner found useful for determination of their RQ category.[16]

Fourth, those hazardous materials classified by DOT as Poison A or Poison B and which do not appear on the CERCLA hazardous substance list, are placed in Hazardous Contaminant Category 1.

For purposes of the joint-use study, therefore, there are four categories of hazardous contaminants:

(1) Category 1, which contains all CERCLA hazardous substances and hazardous contaminants whose toxic effect primary criteria RQs result in, or if evaluated, would

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[16]Although only CERCLA hazardous substances are assigned RQs (see CERCLA Section 102(a)), the methodology, for purposes of this study, can also be applied to hazardous contaminants that are not CERCLA hazardous substances.

result in an RQ of one pound, and all those hazardous materials that are not CERCLA hazardous substances and are classified by DOT as Poison A or Poison B;

(2) Category 2, which contains all CERCLA hazardous substances and hazardous contaminants whose toxic effect primary criteria RQs are, or would be, 10 pounds;

(3) Category 3, which contains all those CERCLA hazardous substances and hazardous contaminants whose toxic effect primary criteria RQs are, or would be, 100 pounds; and

(4) Category 4, which contains all those CERCLA hazardous substances and hazardous contaminants whose toxic effect primary criteria RQs are, or would be, 1000 or 5000 pounds. This category also contains all those DOT hazardous materials that do not exhibit a toxic or carcinogenic effect but are considered hazardous for other reasons.

2.3.2 Categorization of Nonhazardous Goods

The general category of nonhazardous goods includes anything that is not a hazardous contaminant. Goods are generally defined to be personal property having an intrinsic commercial value, which would exclude waste, which has no intrinsic value. Section 118(j) of SARA does not appear to make this distinction, however, and therefore nonhazardous wastes will be included here as nonhazardous goods.

For the purposes of this study, the Agency has chosen to segregate nonhazardous goods into four categories based on use:

(1) foodstuff (before and after processing and including potable water);

(2) fibers (including raw materials such as cotton, nylon, and finished goods);

(3) materials for agricultural application (including fertilizers, pesticides, herbicides, fill dirt, sludge, etc);[17]

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[17]The Agency is aware that many materials, such as fertilizers, pesticides, and herbicides, are themselves hazardous. It is possible, however, that some hazardous substance or product intended for a beneficial agricultural purpose (and, therefore, not a contaminant) could itself, if improperly handled, become contaminated with some hazardous contaminant and become detrimental to the environment, a crop, or some member of the food chain. Similarly, some fuels (considered hazardous materials by DOT) could also become adulterated with a hazardous contaminant, or, conceivably, a nonhazardous product, and produce some deleterious effect. For this reason, contamination of certain hazardous substances or materials by hazardous contaminants is also considered.

(4) other nonhazardous goods (including furniture, appliances, building materials, fuels, monomers, raw plastics, chemicals, waste, scrap, etc.).

EPA realizes that these categories are very broad and that some commodities, depending on their intended use, may fall into more than one category at different times. It is believed, however, that these categories will suffice for the development and characterization of some scenarios illustrative of the potential contamination problem referenced in SARA Section 118(j).

2.3.3 Comparison of Hazardous Contaminants With Nonhazardous Goods

Comparison of four hazardous contaminant categories with four categories of nonhazardous goods leads to 16 combinations of hazardous contaminants with nonhazardous goods, as illustrated by the matrix in Exhibit 2-10. Each of the 16 cells in Exhibit 2-10 represents a relative ranking of contamination incident. Each incident within a class can be more or less serious, but each class has, in general, a very high, high, medium, or lower potential for serious consequences to public health or the environment. The Agency's judgment of the relative hazard for each class of contamination incident has been shown in the Exhibit.

The category containing "other nonhazardous goods" potentially contains a wide variety of commodities. None, however, would be intended for human or animal consumption and few, if any, would remain in prolonged human contact (such as clothing or bedding). For this reason, the Agency believes that, for illustrative purposes in this study, contamination incidents involving "other nonhazardous goods" are likely to have less serious consequences as compared to the consequences of many other contamination incidents.

In the next section, a few contamination scenarios are developed and the potential for each to cause harm to the public health and the environment is analyzed.

2.4 POTENTIAL CONTAMINATION SCENARIOS

Section 2.2 of this chapter described some historical examples of contamination that occurred during transportation of nonhazardous goods. Many of these problems resulted from leaking packages of hazardous contaminants. Current regulations address the problem of leaking packages of hazardous contaminants (see Chapter 3 of this report), but these incidents illustrate the potential consequences of such contamination. Section 2.3 of this chapter develops methods for categorization of hazardous contaminants and nonhazardous goods and applies them to a matrix for comparison of the various categories. Section 2.4 examines some of the matrix intersections in light of the history presented in Section 2.2 and draws conclusions concerning the potential seriousness of various contamination scenarios.

2.4.1 Contamination Scenarios With Potentially Serious Consequences

The Agency believes that the most serious consequences to public health and the environment are likely to occur when foodstuffs or fibers become

Exhibit 2–10

Illustration of the Relative Hazards from Contamination of Nonhazardous Goods by Hazardous Contaminants

Hazardous Contaminants

Nonhazardous Goods	1	2	3	4
Food	Very High	High	Med	Lower
Fibers	High	Med	Lower	Lower
Agriapp†	Med	Lower	Lower	Lower
Other	Lower	Lower	Lower	Lower

† Materials for Agricultural Application

contaminated with highly toxic materials falling into hazardous contaminant Categories 1 or 2. This conclusion is based upon examination of the historical data presented in Section 2.2 of this report which reveal that all but one of the documented incidents involved Category 1 or Category 2 hazardous contaminants affecting food or fiber nonhazardous goods.

Scenario 1. Exhibit 2-9 in Section 2.2.1 of this report documents nearly 1800 injuries due to parathion poisoning and more than 200 deaths occurring overseas in a period of 11 years resulting from contamination during transport or storage. Case 2 in Section 2.2.2 suggests that joint use of liquid tank trucks hauling hazardous contaminants and potable water does occur. The potential consequences are serious if, for example, a truck used for servicing parathion spray rigs in an agricultural area were to be pressed into service to haul water for disaster relief. A possible locale for such a scenario is the San Joaquin Valley of California. This heavily agricultural area is also threatened with earthquakes from a variety of faults in the valley and that run along the base of the mountains to the northeast. In an earthquake emergency, disaster relief officials might unknowingly hire such a truck and trailer from a local agricultural supplier to haul water to an affected area. As exemplified in Case 2 of Section 2.2.1 involving the contaminated flannelette sheets, exposure to minute concentrations of parathion, a Category 1 hazardous contaminant, can have serious adverse consequences.

Scenario 2. Contamination of foodstuffs with less hazardous contaminants would, in general, present a less serious problem than contamination with more hazardous contaminants. The potential for harm, however, is still high. Several mercury compounds, for example, have 10-pound RQs (40 CFR §302.4) and fall into hazardous contaminant Category 2. Mercury is an insidious poison which, after absorption, circulates in the blood and is stored in the liver, kidneys, spleen, and bone. The chief toxic effect of mercury poisoning occurs to the central nervous system and produces tremors, psychic disturbances, coma and, in high enough concentrations, death.[18] Mercury compounds are widely used in manufacturing, industry, and research. As a consequence, they are regularly shipped throughout the United States. If a mercury compound were to be hauled in a railroad hopper car that was subsequently loaded with grain (as occurred in the lead oxide-grain contamination case listed in Exhibit 2-9) before being properly cleaned, death or serious illness could result.

Scenario 3. In recent years, deregulation of the trucking industry and significant increases in the price of fuel have both increased competition and reduced the profit margin in many segments of the industry. These factors have increased the economic incentive for truckers to haul loads on both an outbound trip and the return trip (known as the "back haul"). A possible contamination scenario begins with the operator of a dump truck hauling hazardous waste (e.g., PCBs, a Category 1 hazardous contaminant, as in the case shown in Exhibit 2-9) to a distant hazardous waste disposal site. While

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[18] Sax, N. Irving, Dangerous Properties of Industrial Materials, 5th Edition, Van Nostrand Reinhold Company, New York (1979), page 798.

purchasing fuel at a local truck stop, the dump truck operator notices a bulletin board listing opportunities for a back haul. Although truck decontamination facilities are not readily available at this local truck stop, a load of grain destined for a mill near home is ready to be transported. The trucker is unaware that many hazardous contaminants are not water-soluble and for complete removal require a solvent rinse. Therefore, the trucker merely hoses out his truck, removes any placards, and proceeds to the local grain silo. Most truckers hauling hazardous materials are trained to recognize the hazards associated with their loads, and, even though the probability of such a scenario occurring may be low, the consequences could be serious.

Scenario 4. The legislative history[19] concerning SARA and the joint use of trucks suggests that sludge haulers who also carry hazardous waste present a joint-use concern. Sludge is the solid or semisolid residue which settles to the bottom of treatment ponds or settling basins in sewage treatment plants. This material must be removed and disposed of on a regular basis. Sludge from treatment plants that handle domestic sewage is rich in nutrients, therefore, it is often used as a material for agricultural application. If contaminated with a Category 1 hazardous contaminant, an adverse effect on public health and the environment may result.

A contamination event might begin with a sludge hauler participating in the cleanup of a hazardous waste site. These sites typically contain a wide variety of hazardous contaminants, many of which could belong in Category 1. In the worst case, a truck that had been used to haul a bioaccumulative hazardous contaminant (e.g., DDT and kepone are known to accumulate and concentrate in the food chain[20] and are Category 1 hazardous contaminants) present at the hazardous waste site might be used to haul sludge that is to be used as a fertilizer. Due to insufficient or no cleaning, the truckload of sludge becomes contaminated. Although the concentration of hazardous contaminant in the sludge is low, it may be accumulated and concentrated in the food crop and, therefore, may present a significant hazard to those in the food chain who consume it.

Scenario 5. A high or medium potential for harm also exists if natural or synthetic fibers or finished goods are contaminated with a Category 1 or 2 hazardous contaminant. Section 2.2.1 of this report clearly demonstrates the potential for harm through contamination of finished goods such as sheets and clothing. The potential for harm is substantial if cotton were to be accidentally contaminated with a concentrated organophosphorus-based pesticide.

Cotton, after harvesting, is usually pressed into large bales, at a location near the fields, for shipment to processing facilities. Pesticides are commonly used on cotton crops for control of a variety of insects. Cotton

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[19] 131 Congressional Record H11193 (Daily Ed. December 5, 1985).

[20] See Casarett, L.J. and Doull, J., The Basic Science of Poisons, Macmillan Publishing Co., New York, 1975, Page 411.

bales, therefore, are often found in the vicinity of pesticides stored in concentrated form. Trucks or rail cars used for the transport of pesticides might be pressed into service for the transport of cotton bales and such joint use presents an opportunity for contamination of the cotton. Cotton is thoroughly washed and inspected before being spun into thread for use in making clothing and fabrics and, therefore, it is not likely that contaminated cotton would carry significant amounts of contamination to finished goods. Employees at ginning and milling facilities, however, are at risk and could be exposed to significant concentrations of pesticide through the route described above. In addition, discarded "stained" cotton might provide a hazard to the environment or individuals who come into contact with it.

2.4.2 Contamination Scenarios With Potentially Less Serious Consequences

The consequences resulting from the consumption of contaminated foodstuffs can range from death through illness to mild discomfort or no noticeable effect. Equal concentrations of progressively less hazardous contaminants would be likely to produce effects in this order. Conversely, higher concentrations of less hazardous contaminants are necessary to produce more serious consequences. As a result of this analysis, the Agency believes that, as the hazardous contaminant categories proceed from 1 through 4, the potential hazard goes from "very high" and "high" through "medium" to "lower."

There will be exceptions to this generalization due to the wide variety of individual materials, substances, and wastes found in various hazardous contaminant categories. It is inevitable that a hazardous contaminant found in a "lower" group will be found to have caused some serious problem. The strength of the analysis, however, is in its ability to generalize; individual exceptions, therefore, do not diminish its validity.

Similarly, the Agency believes that as one proceeds down the ordinate in Exhibit 2-10 from foodstuffs through other nonhazardous goods, the potential for harm due to contamination decreases. Exceptions will most likely be found to this generalization as well.

A contamination incident involving Freon 12 and propane reported to the Agency and included in Exhibit 2-9 exemplifies the uncertainties involved in determining where to place a contaminant in Exhibit 2-10. In addition, the contaminated "nonhazardous good" in this case is a fuel (propane) and falls into the other nonhazardous goods category, low on the ordinate of Exhibit 2-10. This incident involved the contamination of propane by Freon 12 and qualifies as a joint-use incident because a truck normally used to transport propane was used temporarily for storage of Freon 12. When the truck returned to propane service, some Freon 12 remained in the tank. Freon 12 is a hazardous material under DOT regulations because it is a compressed gas and, in itself, is not toxic when properly handled. This places it in the hazardous contaminant Category 4. The contaminated propane was widely distributed to homes for use as a cooking and space heating fuel. When Freon 12 is burned, as in a flame, several toxic gases are produced including hydrogen fluoride, a member of hazardous contaminant Category 2. In this case, 76 persons were known to be injured, and many homes were rendered uninhabitable for an extended period of time.

2.5 CONCLUSION REGARDING JOINT USE CONTAMINATION

Reference to Exhibit 2-10 shows that EPA considers 6 of the 16 generalized joint-use contamination scenarios to have a very high, high, or medium potential for harm to the public health or the environment even though the probability for the occurrence of a contamination incident may be low. The remainder, with exceptions, will be less likely to cause human or environmental harm if an incident should occur. Some of the examples that were found reveal serious consequences, while others had no lasting effect. Regardless of the number of incidents of joint-use contamination uncovered in the search, the potential for harm to the public health and the environment exists even if the probability that such harm may occur is low. Because chemical poisoning is relatively rare in the general population and many physicians are not trained to recognize the various symptoms, it is possible that some cases of joint-use contamination in which the result of the poisoning was death or illness may not have been recognized as such. Other examples in which an effect did not occur immediately following exposure[21] will probably never be recognized. Furthermore, a number of joint-use contamination incidents may exist in which no discernable effect on an individual is obvious, but in which an effect on a population might be found if studied under proper conditions.[22] The number of documented cases of joint-use contamination found by the Agency is low (only six were identified in the United States) and this may indicate that the problem is small; however, among the documented cases, pesticides are the most frequently identified contaminants.

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[21]Carcinogens, for example, may induce a tumor onset years or decades after exposure.

[22]An example of such a population effect is subacute lead toxicity in children, which has been correlated with behavioral and cognitive defects (see, Hodgson and Guthrie, Introduction to Biochemical Toxicology, Elsevier, New York, 1980, page 240).

CHAPTER 3

SELECTED REGULATIONS RELATING TO THE SIMULTANEOUS AND SEQUENTIAL TRANSPORTATION OF HAZARDOUS AND NONHAZARDOUS MATERIALS

The U.S. Department of Transportation (DOT) is the primary Federal agency with responsibility for establishing and enforcing regulations regarding the transportation of hazardous materials. The Hazardous Materials Transportation Act (HMTA) gives DOT broad authority to promulgate regulations governing the transportation of hazardous materials by all transportation modes (rail, air craft, vessel, and public highway). The DOT Research and Special Programs Administration (RSPA) is the lead DOT administration that issues the majority of hazardous materials transportation regulations,[1] but other DOT modal administrations, such as the Federal Highway Administration and the Federal Railroad Administration, also have rulemaking and enforcement authority. Relevant RSPA regulations, summarized in Exhibit 3-1, are contained in Title 49 of the Code of Federal Regulations (CFR). The Hazardous Materials Table, in 49 CFR §172.101, and the Appendix to §172.101, list many common hazardous materials and substances, respectively, subject to the regulations.

Hazardous substances, as defined by the Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are listed and regulated as DOT hazardous materials.[2] Those hazardous materials that do not fit within an existing DOT hazard class are considered "Other Regulated Materials" (ORM) Class E.[3] Shippers must determine the appropriate hazard class (see Exhibit 3-2 for a description of the hazard classes) for such materials based on definitions in the regulations. As discussed in Section 3.1.1, some DOT regulatory provisions do not apply to ORM-E materials. In addition, a CERCLA hazardous substance (other than an ORM-E substance) present in a packaging in an amount less than the reportable quantity (RQ) established for the substance by EPA is not considered a DOT hazardous substance, nor a DOT hazardous material.

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[1]The U.S. Coast Guard, however, has authority to regulate bulk marine shipments of hazardous materials (see 46 CFR Parts D, I, N, and O). Additional requirements for certain ships and barges that carry bulk oil shipments are prescribed in 33 CFR Part 157.

[2]Section 202 of the Superfund Amendments and Reauthorization Act of 1986 (SARA) amended CERCLA to require that DOT list and regulate as hazardous materials all CERCLA hazardous substances.

[3]ORM-E represents a wide variety of materials, some of which do not present a particular threat of contamination (i.e., food additives or products).

EXHIBIT 3-1

SUMMARY OF SELECTED U.S. DEPARTMENT OF TRANSPORTATION HAZARDOUS MATERIALS REGULATIONS IN TITLE 49 OF THE CODE OF FEDERAL REGULATIONS

Part 171 is a general introduction to the hazardous materials regulations. Special requirements for hazardous wastes are included, as well as definitions of terms and a list of technical documents incorporated by reference into the regulations. Reporting requirements for hazardous materials incidents also are specified.

Part 172 contains the Hazardous Materials Table. The table lists the hazardous materials and hazard classes subject to regulation; appropriate requirements for labels, packaging, and air and water shipments are referenced. In addition, Part 172 includes detailed regulations for shipping papers, markings, labels, and placards.

Part 173 indicates the types of packagings that may be used by shippers of hazardous materials. General shipment and packaging regulations are followed by more specific requirements for certain hazard classes. Hazard class definitions as well as provisions for reuse of packagings and handling of empty packagings also are contained in Part 173.

Part 174 prescribes regulations for rail transport of hazardous materials. General operating, handling, and loading requirements are specified, as well as detailed requirements for certain hazard classes.

Part 177 contains regulations for the highway transport of hazardous materials; they apply to common, contract, and private carriers. In addition to regulations for handling, loading, and stowage, routing rules for high-level radioactive materials and other in transit requirements are specified.

Part 178 presents detailed specifications for the fabrication and testing of packagings described in Part 173.

Part 179 prescribes detailed specifications for rail tank cars. Procedures for obtaining Association of American Railroads approval of new tank car designs or changes to existing ones are provided.

SOURCE: U.S. Congress, Office of Technology Assessment, "Transportation of Hazardous Materials," OTA-SET-304 (Washington, D.C.: U.S. Government Printing Office, July 1986).

Although DOT hazardous materials regulations most comprehensively regulate the transportation of hazardous materials, other Federal agencies have regulatory responsibilities that also may affect joint use and the contamination of vehicles. In addition to its program for designation of hazardous substances and notification under CERCLA and the Clean Water Act, EPA has promulgated regulatory provisions related to hazardous substances under other statutes, such as the Solid Waste Disposal Act, also known as the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Under RCRA, EPA has established requirements, such as the hazardous waste manifest system, for generators and transporters of hazardous wastes, and for hazardous waste treatment, storage, and disposal facilities. Regulations promulgated pursuant to TSCA address containers and vehicles containing polychlorinated biphenyls (PCBs), and FIFRA regulations concern shipments of pesticides. The Nuclear Regulatory Commission (NRC) regulates the receipt, possession, use, and transfer of nuclear materials. The NRC regulatory provisions include standards for the design and performance of packages to carry radioactive materials and a manifest tracking system for waste disposal. The NRC regulations also require transporters of NRC-licensed material to comply with all applicable DOT regulations. Food and Drug Administration (FDA) regulations contain several provisions designed to prevent or detect contamination of food and drug products that may occur during transportation. All of these regulations are discussed in more detail in Section 3.1 of this chapter.

The DOT regulations apply generally to all interstate motor vehicle and all rail transportation of hazardous materials. In addition, the regulations cover intrastate motor vehicle shipments of hazardous wastes and substances, flammable cryogenic liquids, and licensed radioactive materials. Other hazardous materials in intrastate motor vehicle shipments are not covered by the Federal regulations. States, however, must adopt and enforce DOT's hazardous materials regulations or compatible State rules to be eligible to receive funds for motor vehicle safety programs. Thus, nearly all States have adopted the DOT regulations at least in part,[4] and some, such as New York, have additional requirements for hazardous wastes.

This chapter reviews the Federal and State regulations relating to joint use of vehicles for transportation of hazardous and nonhazardous materials and identifies the areas where regulatory requirements may not be sufficient to prevent contamination of nonhazardous goods. Section 3.1 describes existing regulations as they apply to the shipper, carrier, and receiver. Each of these segments of the transportation industry is required to some extent to take precautions against contamination of nonhazardous goods. Section 3.2 addresses the specific concerns raised by Congressman Smith of New Jersey who proposed the amendment that mandated this study by analyzing existing and

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[4]U.S. Congress, Office of Technology Assessment, "Transportation of Hazardous Materials," OTA-SET-304 (Washington, D.C.: U.S. Government Printing Office, July 1986).

emerging regulatory provisions that control the sequential transportation of hazardous wastes and sewage sludge. Section 3.3 examines the three transportation scenarios that can cause contamination of nonhazardous goods by hazardous materials. Each scenario is analyzed to determine the existing regulatory coverage that could prevent the contamination incident or the realization of significant harm resulting from the contamination and apparent gaps in the regulatory coverage. Considering that DOT and other federal regulations were drafted for purposes other than protecting against joint-use problems, the coverage is surprisingly comprehensive.

3.1 REGULATION OF SHIPPERS, CARRIERS, AND RECEIVERS

Several existing regulations relating to the transportation of hazardous materials could protect the public from exposure to goods contaminated as a result of the shipping of such goods in a vehicle used previously or simultaneously to transport hazardous materials. In each subsection below, a summary and analysis of the regulations as they apply to shippers, carriers, and receivers, respectively, is provided.

3.1.1 Regulation of Shippers

Shippers are responsible for identifying hazardous materials (including hazardous substances and hazardous wastes) offered for transportation and for describing the materials on shipping papers that must accompany the shipment (49 CFR §172.200). Shipping papers include information on the quantity of material transported and its hazard class. Some hazardous materials and their appropriate hazard classes are listed in the Hazardous Materials Table in 49 CFR §172.101 and the Appendix to §172.101. Exhibit 3-2 presents the hazard classes prescribed by that regulation. As mentioned above, for materials not listed specifically, shippers must determine the appropriate hazard class based on definitions in the regulations.

Marking, Labeling, and Placarding

Shippers also must comply with requirements for marking, labeling, and placarding. Marking, labeling, and placarding are all methods of communicating the hazards represented by the material contained in a package or vehicle. Markings simply show the name and identification number of a hazardous material. Labels and placards (placards are somewhat larger than labels), by contrast, are symbols representing the types of hazards associated with a particular material (see Exhibit 3-3). Generally, markings and labels are affixed to packages, while placards are affixed to transport vehicles (i.e., motor vehicles and rail cars). Marking is required, however, for some vehicles that are considered "packagings," such as cargo tanks and tank cars (49 CFR §§172.328, 172.330).

Portable tanks, cargo tanks, and tank cars must remain marked when empty unless reloaded with nonhazardous material or "sufficiently cleaned of residue and purged of vapor to remove any potential hazard." (49 CFR §§172.326, 172.328, 172.330). Such a marked cargo or portable tank or tank car may not be used to transport any other material unless the marking is removed or

EXHIBIT 3-2

DEPARTMENT OF TRANSPORTATION HAZARD CLASSES

Hazard class	Definition	Examples
Flammable liquid	Any liquid having a flash point below 100°F as determined by tests listed in 49 CFR §173.115(d). Exceptions are listed in 49 CFR §173.115(a).	Ethyl alcohol, gasoline, acetone, benzene, dimethyl sulfide.
Combustible liquid	Any liquid having a flash point at or above 100°F and below 200°F as determined by tests listed in 49 CFR §173.115(d). Exceptions are listed in 49 CFR §173.115(b).	Ink, methyl amyl ketone, fuel oil.
Flammable solid	Any solid material, other than an explosive, that can cause fires through friction or retained heat from manufacturing or processing, or which can be ignited readily, creating a serous transportation hazard because it burns vigorously and persistently (49 CFR §173.150).	Nitrocellulose (film), phosphorus, charcoal.
Oxidizer	A substance such as chlorate, permanganate, inorganic perodide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter (49 CFR §173.151).	Potassium bromate, hydrogen peroxide solution, chromic acid.
Organic peroxide	An organic compound containing the bivalent -0-0- structure and which may be considered a derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by organic radicals. Exceptions are listed in 49 CFR §173.151(a).	Urea peroxide, benzoyl peroxide.
Corrosive	Liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact. Liquids that severely corrode steel are included (49 CFR §173.240(a)).	Bromine, soda lime, hydrochloric acid, sodium hydroxide solution.
Flammable gas	A compressed gas, as defined in 49 CFR §173.300(a), that meets certain flammability requirements (49 CFR §173.300(b)).	Butadiene, engine starting fluid, hydrogen, liquefied petroleum gas.
Nonflammable gas	A compressed gas other than a flammable gas.	Chlorine, xenon, neon, anhydrous ammonia.
Irritating material	A liquid or solid substance which on contact with fire or when exposed to air gives off dangerous or intensely irritating fumes. Poison A materials excluded (49 CFR §173.381).	Tear gas, monochloroacetone.
Poison A	Extremely dangerous poison gases or liquids belong to this class. Very small amounts of these gases or vapors of these liquids, mixed with air, are dangerous to human and animal life (49 CFR §173.326).	Hydrocyanic acid, bromoacetone, nitric oxide, phosgene.

EXHIBIT 3-2 (continued)

DEPARTMENT OF TRANSPORTATION HAZARD CLASSES

Hazard class	Definition	Examples
Poison B	Substances, liquids, or solids (including pastes and semi-solids), other than Poison A or irritating materials, that are known to be toxic to humans. In the absence of adequate data on human toxicity, materials are presumed to be toxic to humans if they exhibit oral, dermal, or inhalation toxicity in laboratory animals exposed under specific conditions.	Phenol, nitroaniline, parathion, cyanide, mercury-based pesticides, disinfectants.
Etiologic agents	A viable micro-organism, or its toxin, which causes or may cause human disease. These materials are limited to agents listed by the Department of Health and Human Services (49 CFR §173.386; 42 CFR §72.3).	Vibrio cholerae; Clostridium botulinum; polio virus; salmonella, all serotypes.
Radioactive material	A material that spontaneously emits ionizing radiation having a specific activity greater than 0.002 micro-curies per gram. Further classifications are made within this category according to levels of radio-activity (49 CFR §173, subpart I).	Thorium nitrate, uranium hexafluoride.
Explosive	Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, unless such compound, mixture, or device is otherwise classified (49 CFR §173.50).	
	Explosives are divided into three subclasses:	
	Class A exposives are detonating explosives (49 CFR §173.53);	Jet thrust unit, explosive booster.
	Class B explosives generally function by rapid combustion rather than detonation (49 CFR §173.88); and	Torpedo, propellant explosive.
	Class C explosives are manufactured articles, such as small arms ammunition, that contain restricted quantities of Class A and/or Class B explosives, and certain types of fireworks (49 CFR §173.100).	Toy caps, trick matches, signal flares, fireworks.
Blasting agent	A material designed for blasting, but so insensitive that there is very little probability of ignition during transport (49 CFR §173.114a).	Ammonium nitrate -- fuel oil mixture.

EXHIBIT 3-2 (continued)

DEPARTMENT OF TRANSPORTATION HAZARD CLASSES

Hazard class	Definition	Examples
ORM (Other Regulated Materials	Any material that does not meet the definition of the other hazard classes. ORMs are divided into five substances:	
	ORM-A is a material which has an anesthetic, irritating, noxious, toxic, or other similar property and can cause extreme annoyance or discomfort to passengers and crew in the event of leakage during transportation (49 CFR §173.500(b)(1).	Trichloroethylene, carbon tetrachloride, ethylene dibromide, chloroform.
	ORM-B is a material capable of causing significant damage to a transport vehicle or vessel if leaked. This class includes materials that may be corrosive to aluminum (49 CFR §173.500(b)(2)).	Calcium oxide, ferric chloride, potassium fluoride.
	ORM-C is a material which has other inherent characteristics not described as an ORM-A or ORM-B, but which make it unsuitable for shipment unless properly identified and prepared for transportation. Each ORM-C material is specifically named in the Hazardous Materials Table in 49 CFR §172.101 (49 CFR §173.500(b)(3)).	Castor beans, cotton, inflatable life rafts.
	ORM-D is a material such as a consumer commodity which, although otherwise subject to regulation, presents a limited hazard during transportation due to its form, quantity, and packaging (49 CFR §173.500(b)(4)).	Consumer commodity not otherwise specified, such as nail polish; small arms ammunition.
	ORM-E is a material that is not included in any other hazard class, but is subject to the requirements of this subchapter. Materials in this class include hazardous wastes and hazardous substances (49 CFR §173.500(b)(5)).	Kepone, lead iodide, heptachlor, polychlorinated biphenyls.

Source: Office of Technology Assessment, "Transportation of Hazardous Materials," U.S. Congress, July 1986, pp. 154-155.

Exhibit 3–3

Examples of Labels and Placards for Hazardous Materials Transportation

Labels

Placards

Source: 49 CFR §§ 172.411–172.558

changed (49 CFR §§172.326(b), 172.328(e), 172.330(d)). For highway transportation, the DOT regulations require that the shipper provide placards to motor carriers, who then must affix them to the motor vehicle (49 CFR §172.506(a)). For all rail cars and for cargo tanks and portable tanks offered for transportation, the placard must be affixed by the shipper (49 CFR §§172.508, 172.514(a)).

In general, the same requirements for classification of hazardous materials, preparation of shipping papers, marking, labeling, and placarding that apply to bulk shippers also apply to shippers of nonbulk packagings. Because packaging is defined to include all containers, the term encompasses reused or reconditioned steel drums (49 CFR §171.8). All packagings containing hazardous materials and having a capacity of 110 gallons or less must be marked.[5] Requirements for small packagings that previously contained hazardous materials are analogous to those for bulk shipments, i.e., the packagings must be offered for transportation in the same manner as required when the packagings contained the hazardous materials, unless they are cleaned and purged of all residue or filled with a nonhazardous material (49 CFR §173.29). When hazardous and nonhazardous materials are described on the same shipping paper, the hazardous materials must either be entered first, highlighted, or otherwise clearly identified, as specified in 49 CFR §172.201(a)(1). DOT regulations specify detailed packaging requirements for hazardous materials (49 CFR Part 173) and provide charts indicating hazardous materials that must not be loaded or stored together (49 CFR §§174.81(f), 177.848(f)).

Regulatory Exemptions

Certain packagings are exempt from DOT regulations. For example, nontank motor vehicles, rail cars, and freight containers containing less than 1000 pounds of specified types of hazardous materials do not have to be placarded (49 CFR §172.504(c)). However, if such vehicles are carrying even small packages of the most dangerous classes (i.e., class A and B explosives, poison A, certain flammable solids, and radioactive materials), the vehicles must be placarded (49 CFR §172.504(c)). Because a package containing less than an RQ of a CERCLA hazardous substance classified as an ORM-E material does not contain a DOT hazardous substance or hazardous material, these packages are exempt from DOT regulatory requirements. In addition, some hazardous materials, including ORM materials, are exempt from the labeling and placarding provisions of DOT regulations (49 CFR §§172.400(b)(8), 172.500(b)). DOT also exempts from placarding requirements hazardous materials authorized to be offered for transportation as "limited quantities" (49 CFR §172.500(b)(3)), and exempts from marking, labeling, and placarding

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[5]DOT has proposed to extend this marking requirement to bulk packagings and nontank bulk transport vehicles. This regulation would require a shipper to affix to the bulk packaging the name or identification number of the hazardous material being transported. In addition, the residue marking and cleaning requirements for tank vehicles (discussed above) would extend to nontank bulk packagings (see 49 FR 38164, September 27, 1984).

requirements any shipment of "small quantities" of flammable liquids and solids, oxidizers, organic peroxides, corrosive materials, poison B, ORM-A, ORM-B, ORM-C, and radioactive materials (49 CFR §173.4(a)).[6]

Material-Specific Requirements

Specific requirements apply to certain hazardous materials. Hazardous wastes regulated under RCRA, for example, require preparation of a manifest by the shipper and associated recordkeeping requirements (40 CFR §§262.20, 263.22). Regulations promulgated under TSCA require special markings for PCB containers and transport vehicles (40 CFR §761.40(b)). FIFRA regulations provide recommendations for handling pesticides, such as treatment of contaminated vehicles and movable equipment prior to their departure or removal from the site (40 CFR §165.10). DOT regulations provide that arsenic dust, certain other dusts, and arsenical compounds may be shipped in specific types of rail cars only if those transport vehicles are assigned exclusively to arsenical service and are marked as such (49 CFR §173.368).

3.1.2 Regulation of Carriers

Carriers accept hazardous materials from shippers, transport these materials in vehicles (e.g., motor vehicles or rail cars), and deliver the materials either to another carrier or to the receiver. In general, hazardous materials need not be shipped in dedicated packagings or transport vehicles. A transport vehicle usually can be used to transport both hazardous and nonhazardous materials, either sequentially or simultaneously.

General Requirements

The regulations reviewed contain very few generic requirements applicable to carriers concerning possible shipments of hazardous and nonhazardous materials. One RCRA regulation states that the equipment used in the transportation of solid waste shall be operated and maintained so as to minimize health and safety hazards to the public (40 CFR §243.202-1(c)). Two FDA regulatory provisions offer overall guidance for the transportation of food products. One requires that all operations related to the transportation of food be conducted in a manner consistent with adequate sanitation principles (21 CFR §110.80), while the other mandates that finished food products be transported under conditions that will prevent contamination (21 CFR §110.80(j)).

Material-Specific Requirements

In addition to these general provisions designed to minimize health and safety risks, there are some regulations that seek to protect certain materials through segregation from other cargo, or by other means. For

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[6]The definition of "limited quantities" and "small quantities" varies by material.

example, carriers may not transport any foodstuffs in the same rail car with any package bearing a poison label (49 CFR §§174.280, 174.380, 174.480, 174.680). Carriers are subject to the same regulatory prohibition with respect to motor vehicles, unless the package bearing a poison label is overpacked by an additional liquid-tight and dust-proof container (49 CFR §§173.25(c), 177.841(e)). Finally, DOT prohibits carriers from accepting for transportation any leaking or damaged packages of explosives (49 CFR §§174.103(c)(1), 177.821).

Cleaning Requirements for Sequential Shipments

A variety of regulations require the cleaning of transport vehicles either after they are used to transport hazardous materials or before they are used to carry nonhazardous materials. For example, regulations in the State of New York prohibit the transportation of items intended for human or animal consumption in a vehicle or container used to transport hazardous waste, unless the waste or residue is completely removed (6 NYAC 27.0909.1). There are no analogous Federal regulations. FDA regulations, however, require cleaning (e.g., vacuuming, sweeping, washing) of any equipment used in the distribution of finished medicated feed when necessary to prevent contamination (21 CFR §225.65). The FDA also provides cleaning procedures for bulk shipment equipment coming in contact with the drug components of certain medicated articles to avoid contamination (21 CFR §226.40(f)).

Other regulations requiring the cleaning of transport vehicles focus on the presence of hazardous materials. DOT regulations mandate that cargo tanks that carry certain flammable liquids must be cleaned before any changes in lading are allowed (49 CFR §173.119). After rail cars carrying either potassium permanganate or poisonous materials in general are unloaded, they must be cleaned thoroughly unless they are used exclusively to carry those materials (49 CFR §§174.515, 174.615(b)). After unloading phosphorous packed in water from a tank car, the party who unloaded the car must fill it completely with an inert gas or to a certain level with water (49 CFR §173.190(b)(3)). Motor vehicles that contained arsenical materials must be flushed with water until all detectable traces of the substances are removed before the vehicle may be used to transport any other materials (49 CFR §177.841(a)(2)). Additionally, DOT requires carriers to inspect their vehicles for contamination after they have been used to transport material marked as or known to be poison A or B. A vehicle which has been found to be contaminated must be decontaminated before it is returned to service, unless the vehicle is used solely for transporting such poisons (49 CFR §177.860). Under FIFRA regulations, delivery trucks that contained pesticides must be decontaminated (40 CFR §165.10(c)(4)). Finally, vehicles in which radioactive materials are spilled cannot be returned to service until the level of radioactivity within the vehicle reaches a specified acceptable level (49 CFR §177.861(a)).

Moreover, if certain hazardous materials are shipped in a container (e.g., a steel drum), reuse of the container is limited or prohibited. For example, steel drums marked "single-trip container" or "nonreusuable container" from which the contents have been removed following use for transportation of any

material may not be reused to transport most hazardous materials unless specified cleaning and reconditioning procedures are followed (49 CFR §173.28(h)). Such steel drums may be reused to transport corrosive solids and ORM-A, B, C, and E materials without cleaning or reconditioning (49 CFR §173.28(n)). If reused to transport flammable solids or liquids, organic peroxides, oxidizers, poisons, radioactive materials, or corrosive liquids, however, the drums must be thoroughly cleaned to remove all residues, inspected for deterioration, and returned to their original shape. If a drum shows evidence of deterioration from rust, corrosion, or cleaning processes or cannot be returned to its original shape, the drum may not be reused (49 CFR §173.28(m)(1)). Polyethylene packagings used to ship poisonous materials may not be reused, except for subsequent shipments of poisons or hazardous wastes (49 CFR §173.28(i)).

Notification and Cleanup Requirements

DOT regulations also address carrier spills and cleanup requirements. Placarded rail cars and any adjacent rail cars must be inspected when loaded (49 CFR §174.8(b)). A rail car containing packages of hazardous materials (other than explosives) may not be offered in interchange if the packages are leaking (49 CFR §174.10(d)). Packages of hazardous materials that are damaged or found to be leaking during rail or highway transportation, and hazardous materials that have spilled or leaked, may be forwarded to their destination or returned to the shipper in a salvage drum (49 CFR §§174.48(b), 177.854(c)(2)). If a leaking package is not placed in a drum, the repair of the package must be adequate to prevent contamination of other materials transported in the same motor vehicle (49 CFR §177.854(d)(2)). When transport vehicles containing certain hazardous materials (explosives, flammable liquids, flammable solids, oxidizing materials, compressed gases, poisons, and radioactive materials) are involved in accidents, DOT regulations prescribe what actions carriers must take to deal with leaking or damaged packagings (49 CFR §§177.855, 177.856, 177.857, 177.859, 177.860, 177.861). These requirements focus primarily on minimizing the hazards to public health as a result of direct exposure to hazardous materials, rather than preventing contamination of any nonhazardous goods in the transport vehicle. In addition, transporters of radioactive materials must notify the shipper immediately of spills of radioactive materials or suspected radioactive contamination (49 CFR §177.861(a)). Finally, railroads must remove all hazardous materials that have leaked from any package in a rail car (49 CFR §174.57). In particular, a rail car that contains packages of poisonous materials that show any evidence of leakage must be cleaned thoroughly after unloading, and inspected before the car is returned to service (49 CFR §174.615).

EPA and DOT regulations also require carriers to provide notification of most incidents relating to the release of hazardous materials during transportation. Under the National Contingency Plan (40 CFR §300.63), a release into the environment of a CERCLA hazardous substance in an amount equal to or greater than its reportable quantity (RQ) must be reported immediately by telephone to the National Response Center. Regulations promulgated under SARA require that releases be reported to State and local

authorities. If, during transportation, any quantity of a hazardous material or a hazardous waste has been unintentionally released from a packaging, a carrier must report this incident in writing to DOT within 15 days of discovering the event (49 CFR §171.16(a)). Additionally, if the hazardous material spill causes a person's death or hospitalization or property damage exceeding $50,000, the carrier must notify DOT by telephone at the earliest practicable moment (49 CFR §171.15). This notification must then be followed by a written report, as required for other releases of hazardous materials (49 CFR §171.16(a)).

Disclosure Provisions

In addition to the regulations requiring carriers of hazardous or nonhazardous materials to follow certain protective measures, other DOT provisions require shippers and carriers to inform other parties of the hazardous contents of a transport vehicle. These disclosure requirements begin with the shipping papers accompanying the shipment of hazardous materials. If a motor carrier offers or delivers to a rail carrier for further transportation a freight container or transport vehicle containing a hazardous material requiring a placard, the kind of placard must be identified in the shipping paper (49 CFR §177.817(c)). For any packagings, including tank cars that contain the residue of a hazardous substance, the shipping papers must include the phrase "RESIDUE: Last Contained * * * " and the letters "RQ" in addition to the basic description of the hazardous substance last contained in the packaging (49 CFR §§172.203(e)(3), 174.25(c)). This requirement also applies to a tank car that contains the residue of a hazardous material other than a hazardous substance, except that no "RQ" notation is required on the shipping papers (49 CFR §174.25(c)). Finally, for any packagings other than tank cars that contain the residue of a hazardous material, the words "RESIDUE: Last Contained * * *" may be included on the shipping paper, but the shipper is not required to include this information (49 CFR §172.203(e)(1)).

DOT disclosure provisions also extend to the marking and placarding of transport vehicles. DOT requires that any carrier of hazardous materials comply with applicable placarding requirements (49 CFR §172.500(a)). Any cargo tank, portable tank, or tank car that is marked as containing a hazardous material (except combustible liquids) must remain marked when empty, unless it is reloaded with a nonhazardous material or is cleaned sufficiently of residue and purged of vapor to remove any potential hazard (49 CFR §§172.326(e), 172.328(f), 172.330(g)). Each tank car containing the residue of a hazardous material must be placarded by the party who unloaded the material with the residue placards in the tank car, unless the tank car is reloaded with a material requiring no placards or different placards, or is sufficiently cleaned of residue and purged of vapor to remove any potential hazard (49 CFR §§172.510(c), 174.69). Each cargo tank and portable tank that is placarded as containing a hazardous material must remain placarded when it is empty, unless it is reloaded with a nonhazardous material or sufficiently cleaned and purged of vapors to remove any potential hazard (49 CFR §172.514(b)).

Additional disclosure requirements apply only to transportation of hazardous waste. There are manifest requirements under both DOT and RCRA, with RCRA regulations requiring that carriers of hazardous wastes sign a manifest acknowledging acceptance of the waste and provide a copy of the manifest to any subsequent carrier or to the receiver (40 CFR §263.20). The manifest must indicate the amount of the hazardous waste shipped and received. RCRA and DOT regulations require the carrier to deliver to the recipient the entire quantity of hazardous waste designated on the manifest (40 CFR §263.21(a), 49 CFR §171.3(b)).

3.1.3 Regulation of Receivers

Federal regulations apply equally to the receivers of bulk and package shipments. General requirements relating to the receivers of hazardous materials include requirements that shipments be accompanied by either shipping papers, manifests, or other appropriate documents, and that interstate shipments must have Interstate Commerce Commission bills of lading. Such documents normally contain descriptions of the goods shipped and may include the quantity of goods, terms of payment, and other conditions of delivery.

Some specific requirements govern the receipt of particular items or types of items. Under RCRA, receivers of hazardous waste must verify, on the RCRA manifest accompanying the shipment, that the quantity of hazardous waste received corresponds to the quantity shipped, and must return the manifest to the generator that initiated the shipment (40 CFR §264.71). If there is a significant discrepancy between the quantity of hazardous waste listed on the manifest, and the quantity received (for bulk shipments, a variation greater than 10 percent in weight), the facility receiving the waste must reconcile the discrepancy with the carrier within 15 days or notify the EPA Regional Administrator (40 CFR §264.72). Under FDA regulations, receivers of raw materials and ingredients for food must inspect these items to ensure that they are clean, wholesome, and fit for processing into human food. Raw materials must be washed and cleaned to remove any soil or other contamination (21 CFR §110.80(a)). Additionally, any containers and carriers of raw materials should be inspected on receipt to ensure that their condition did not contribute to the contamination or deterioration of the products (21 CFR §110.80(h)).

In addition to these requirements for food products, FDA also regulates receipt of drug products. Any incoming shipment of drugs to be used in medicated animal feed must be examined visually for damage that may have adversely affected its identity, strength, quality, or purity (21 CFR §225.42(b)(1)). If any such damage is found, the drugs may not be accepted for use. Additionally, upon receipt and before acceptance, drug product containers must be examined visually for any contamination (21 CFR §221.82(a)).

3.1.4 Summary of Regulatory Coverage

Exhibit 3-4 summarizes the regulatory responsibilities as they pertain to actions by shippers, carriers, and receivers.

EXHIBIT 3-4

SUMMARY OF REGULATORY COVERAGE IN JOINT USE OF VEHICLES

Regulatory Areas	Shipper	Carrier	Carrier Check*	Receiver
Material identification and classification	X			
Packaging	X		X	
Segregation and protection of cargo		X		
Labeling	X		X	
Marking	X		X	
Placarding	X	X	X	
Shipping papers	X		X	
Accident and spill reporting		X		
Cleaning of transport vehicle		X		
Inspection of incoming shipments of nonhazardous goods for contamination				X
Mode-specific requirements		X		

*The carrier is required to verify the shipper's compliance with these regulatory responsibilities.

Source: ICF analysis of Hoxie and Woodman, "Risks of Hazardous Substance Spills from Unmarked Packages or Containers," U.S. Department of Transportation, 1982, p. 19.

3.2 SEQUENTIAL TRANSPORTATION OF HAZARDOUS WASTE AND SEWAGE SLUDGE

Congressional concern, resulting in the enactment of Section 118(j) of SARA, was based on information about a sludge hauler who was transporting sludge for land application at a sod farm using trucks that previously had hauled hazardous wastes. The legislative history of Section 118(j) notes that most States have few, if any, regulations relevant to sludge, and that sludge is being used increasingly by farmers as fertilizer for a variety of crops.

Two forthcoming EPA regulations are relevant to this scenario. Technical criteria for sludge disposal currently are under development by EPA and may be incorporated into National Pollutant Discharge Elimination System (NPDES) permits under the Clean Water Act. The proposed criteria, in the form of maximum concentration levels for heavy metals, PCBs, and other pollutants found in sludge, generally vary by disposal method. EPA data indicate that 41 percent of all sludge is disposed of by landfilling, 20 percent by incineration, 25 percent by land application (including distribution and marketing), and 7 percent by ocean dumping. The remaining 7 percent is disposed of by other means including pits, ponds, and lagoons.[7] The lowest concentration limits may be set for incineration because of the human health and environmental risks from airborne pollutants. One key issue with regard to joint use of vehicles is whether the sludge pollutant levels will be measured before or after transportation to the disposal site. If the criteria are applied after transportation, possible contamination of the sludge from a previous load of hazardous waste could be taken into account.

Another regulatory action that could affect sewage sludge is the "toxic characteristics leaching procedure" (TCLP) proposed by EPA in June 1986 (51 FR 21648) as a test for determining whether wastes are hazardous under RCRA. Several municipal wastewater treatment agencies have expressed concern that the proposed test may result in sewage sludge being classified as a hazardous waste. If this were the case, the effect on joint use of vehicles to transport hazardous waste and sludge sequentially might be that DOT regulatory provisions addressing transportation of one hazardous material followed by transportation of a different hazardous material would apply. Of 18 municipal sludge samples recently tested by EPA, none failed the TCLP test.[8] Because these results are preliminary in that they represent only a small percentage of the over 15,000 municipal sludges, they should not be interpreted to mean that no municipal sludges would fail the TCLP test.

In addition, in many circumstances, existing DOT regulations provide for communication of the potential hazard to the shipper of the sludge. If the hazardous material that was hauled previously had been assigned a hazard class other than ORM, the truck should be placarded. If a cargo tank or portable

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[7]U.S. Environmental Protection Agency, "Draft Preliminary Regulatory Impact Assessment of Sludge Disposal Criteria," December 1986.

[8]U.S. Environmental Protection Agency, Draft Preliminary Analysis.

tank is used, markings on the tank would identify any hazardous material transported immediately prior to loading of the sludge, unless the tank had been cleaned. A potential problem could arise, however, if the vehicle in question is a dump truck (or some other nontank vehicle). If such a vehicle hauls a hazardous substance that is classified as ORM, DOT regulations do not require placarding or marking of the vehicle.[9] In addition, if less than 1000 pounds of certain other types of hazardous materials are transported in a motor vehicle or freight container (other than portable tanks, cargo tanks, and tank cars), that vehicle also does not have to be placarded. Therefore, because a placard or marking is not always required, the sludge shipper may not always be informed of the identity of the previous shipment, and contamination potentially could occur.

To summarize, the concern expressed by Congressman Smith may reflect a serious potential problem in certain circumstances. There is no general regulatory prohibition of joint use of trucks for hauling hazardous materials and sewage sludge and no requirement for truck cleaning. If the hazardous materials do not meet any DOT hazard class definition other than ORM-E, and if the materials are hauled in a dump truck, there are no markings, labeling, or placarding requirements that could warn a subsequent sludge shipper of possible contamination. Forthcoming technical criteria for sludge would provide a safeguard only if the criteria were required to be met after the sludge had been transported.

3.3 EFFECTIVE REGULATORY COVERAGE AND POTENTIAL GAPS

A review and analysis of the existing regulations that govern the shipping, carrying, and receiving of hazardous and nonhazardous materials indicates that although there are regulations that could prevent contamination and resulting harm with respect to particular hazardous materials, there is no comprehensive program to ensure that shipments of nonhazardous goods will not be contaminated by previous or simultaneous shipments of hazardous materials. Furthermore, shippers of hazardous materials are not required to alert subsequent shippers of nonhazardous goods that such goods are subject to contamination when they are transported by a carrier who had previously transported hazardous materials. Under DOT regulations, the shipper has the responsibility to ensure that a vehicle is appropriate for a particular shipment of hazardous materials. Thus, shippers of hazardous materials must always be aware of the condition of the carrier's vehicle (i.e., whether the vehicle is contaminated with an incompatible material). For shippers of nonhazardous goods such as foodstuffs, however, there is no analogous regulatory requirement. Shippers of nonhazardous materials, therefore, are unlikely to focus on whether a vehicle has been contaminated by a previous shipment of hazardous materials and consequently may fail to observe appropriate safety precautions. Few hazardous materials are required to be shipped in dedicated vehicles and there is no universal requirement to clean a vehicle after it is used to transport hazardous materials.

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[9]DOT has proposed to require marking for such nontank bulk transport vehicles (see note 4 above).

Regulations do exist that can provide protection from potential contamination. However, for the most part, these regulations were drafted for two specific purposes: (1) to minimize the potential for mixing different types of hazardous materials that could result in immediate health dangers; and (2) to protect emergency response personnel at the scene of an accident.[10] The DOT regulations generally provide for the disclosure of information regarding the contents of the motor vehicle or rail car, but except in the few special cases, even strict adherence to the regulations would not protect against contamination that could result from insufficient cleaning of a bulk or nonbulk container. Other regulations that cover the joint-use problem to a lesser degree are designed to ensure the integrity of drugs and foodstuffs. Because none of these regulations were drafted to address the problem of joint use, certain regulatory gaps exist.

There are three basic scenarios that could cause contamination of nonhazardous goods during transportation: (1) residue remaining after a bulk shipment of a hazardous material causing contamination of a subsequent shipment of a nonhazardous good in the same vehicle;[11] (2) a spill during shipment of packages of a hazardous material causing contamination of a subsequent shipment of packages of a nonhazardous good in the same vehicle; and (3) a spill during simultaneous shipment of packages of a hazardous material and packages of a nonhazardous material. The regulatory coverage and potential regulatory gaps related to each of these three scenarios are discussed below. A summary of regulatory gaps is provided at the end of this chapter.

3.3.1 Sequential Bulk Shipments

There are several regulatory provisions (discussed below) that apply to sequential bulk shipments of hazardous and nonhazardous materials. Some regulations require notice to a subsequent shipper that a previous shipment involved hazardous material. Other regulations require cleaning of the hazardous material transport vehicle after unloading, or require other precautionary measures. Some of these regulations apply to all hazardous materials and modes of transportation, and some apply only to specific materials or modes of transportation (i.e., only motor vehicle or only rail). Compliance with shipping paper, marking, labeling, and placarding requirements could provide notice to subsequent shippers.

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[10]DOT has noted, however, that marking and labeling of poisons also can be helpful in preventing simultaneous shipments with foodstuffs. See 41 FR 40625, September 20, 1976; 41 FR 15973, April 15, 1976.

[11]Residue of a hazardous material remaining in a drum subsequently reconditioned or reused to transport a nonhazardous material presents a similar threat of contamination. Thus, this chapter treats reuse of drums as a subset of scenario (1).

Marking, Labeling, and Placarding

The DOT regulations require that a cargo tank or portable tank must remain marked and placarded after the hazardous material is unloaded, unless it is reloaded with a nonhazardous good or cleaned sufficiently to eliminate potential hazards. Similarly, a tank car containing the residue of a hazardous material must remain marked and must be affixed with a residue placard unless it is cleaned sufficiently to remove hazards or reloaded with a material requiring different placards or no placards. The shipping paper for such a tank car must note the presence of this placard. If carriers and shippers comply with these marking, residue placarding, and cleaning requirements, either a subsequent shipper of a nonhazardous good would be on notice that the cargo tank, portable tank, or tank car previously contained a hazardous material or the tank will have been cleaned sufficiently to remove potential hazards.

Transportation of ORM hazardous materials in vehicles other than cargo tanks or tank cars appears to be a significant gap in the regulatory coverage. As mentioned above, there are shipping paper, placarding, and cleaning requirements that apply to bulk shipments of hazardous materials. ORM hazardous materials, however, are exempt from general labeling and placarding requirements. Therefore, no vehicles containing ORM materials are required to be placarded or labeled. In addition, the only vehicles required to be marked are cargo tanks and tank cars. Thus, a nontank transport vehicle, such as a dump truck, that contains ORM materials is not required to be placarded, labeled, or marked to identify its contents, and a subsequent shipper of nonhazardous materials using such a nontank vehicle probably would be unaware of the identity of its previous load of hazardous material.

Cleaning and Dedication Requirements

Cleaning and dedication requirements are significant despite their narrow scope (i.e., they apply only to specific hazardous materials) because they contain provisions that would be most likely to prevent contamination of a nonhazardous material in a joint-use situation. For example, DOT regulations prohibit subsequent shipment of nonhazardous goods in any motor vehicle used to ship arsenic dust in bulk. The regulations also provide that a rail car carrying potassium permanganate or other poisonous materials must be cleaned thoroughly after unloading, unless the rail car is used exclusively to carry such materials. Thus, for certain hazardous materials, such as poisonous materials transported in rail cars, DOT regulations require dedication or cleaning before a change of lading.

However, regulatory coverage is not complete. Because of the lack of specific cleaning standards in the hazardous materials regulations, those standards may not fully protect public health and the environment from contamination resulting from joint use. For example, the placard may be removed when a cargo tank or portable tank is cleaned sufficiently "to remove any potential hazard." However, in light of the purposes of the DOT regulations and because the phrase "any potential hazard" is not defined more specifically, a carrier might consider a potential hazard to be one that

results from the chemical or physical reaction between two or more hazardous materials or from the danger to personnel in the event of an accident. Thus, the hazard resulting from possible contamination of a nonhazardous good might not be considered and, consequently, placards may be removed although a threat of contamination might remain.

To some extent, dedication and associated cleaning requirements for many of the most toxic materials do protect against contamination of nonhazardous materials. These regulations, however, apply only to a few specific hazard classes. Most hazardous materials other than poisons transported by rail have no general cleaning or dedication requirement. For example, benzene is classified as a flammable liquid rather than as a poison and therefore no dedication or associated cleaning requirements apply to vehicles carrying benzene. In a recent proposed rulemaking, however, EPA has identified benzene as a potential carcinogen (52 FR 8140, March 16, 1987). Thus, vehicles used to transport certain potential carcinogens (e.g., benzene) need not be assigned exclusively to that service. This gap, along with the uncertainty regarding general cleanup standards for residues, could result in contamination of subsequent shipments of nonhazardous goods.

3.3.2 Sequential Package Shipments

When leakage occurs during the shipment of a packaged hazardous material, contamination of the transport vehicle could result. This could lead to the contamination of nonhazardous materials transported subsequently in the same vehicle and to potential harm when people, animals, or the environment are exposed to the tainted nonhazardous materials. Regulatory requirements that could prevent this sequence of events may be divided into the following categories: (1) notice to authorities when a transportation spill (whether or not wholly contained within the vehicle) occurs; (2) cleanup of released hazardous materials; (3) dedication of vehicles to carriage of hazardous materials only; and (4) inspection of incoming shipments of nonhazardous materials.

Notification Requirements

A first step in attempting to prevent any eventual contamination of nonhazardous materials is for the appropriate government officials to be notified of a spill of hazardous materials during transportation so that effective action can be taken to resolve the problem. Carriers must submit a written "incident report" to DOT within 15 days after discovering that a hazardous material was unintentionally released, or that any amount of hazardous waste was discharged, during transportation. As mentioned in Section 3.1.2, DOT regulations also require carriers to notify DOT by telephone as soon as practicable if, as a direct result of transportation of hazardous materials, a serious incident occurs, such as the spillage of or suspected contamination by radioactive material or etiologic agents. This telephone report must be followed within 15 days by a written report from the carrier to DOT. If a CERCLA hazardous substance is released into the environment in an amount that equals or exceeds the reportable quantity for the substance, CERCLA regulations require immediate notification to the

National Response Center. SARA provisions require State and local notification for certain releases of CERCLA hazardous substances and for SARA extremely hazardous substances. These notification provisions enable govenment authorities to become aware of releases that might cause contamination and to pursue efforts to ensure that tainted transport vehicles are cleaned and/or restricted in subsequent use for transporting nonhazardous materials.

Cleaning and Dedication Requirements

Other regulations provide expressly for the cleaning of transport vehicles, or of the contaminated nonhazardous materials, when leakage of hazardous materials has occurred. DOT requirements relating to accidents involving transport of certain hazardous materials require carriers to take action to remedy leaking or damaged packagings. DOT regulations also require that all hazardous materials spilled in rail cars must be removed. EPA regulations require the decontamination of transport vehicles contaminated with pesticides or PCBs. Compliance with requirements for cleaning or dedication of transport vehicles to only the transport of certain hazardous materials may reduce the possibility of contamination of nonhazardous goods.

The cleaning and dedication provisions for poisons transported by rail apply to sequential package shipments as well as to sequential bulk shipments. Many hazardous materials shipments are not covered by these provisions, however, because they are not poisons transported by rail.

As discussed above, DOT regulations require cleanup of accidental spills of packaged hazardous materials. These regulations do not require, however, that the carrier notify the receiver or a subsequent shipper that a hazardous material has been spilled and cleaned up. Because there are no specific decontamination standards, residue of a spill sufficient to contaminate a subsequent package shipment of a nonhazardous material could remain even after cleanup.

There is an additional regulatory gap related to CERCLA hazardous substances: if a hazardous material is a CERCLA hazardous substance classified as ORM-E packaged in a quantity less than its RQ, and a spill occurs, the DOT notification or cleaning requirements do not apply because the spillage would not be a DOT hazardous substance, and therefore not a hazardous material. Technically, therefore, under DOT regulations, a carrier would not be required to clean up the spill, and contamination of the vehicle could occur. Further, because the package originally contained less than an RQ, the carrier may not have knowledge that a CERCLA hazardous substance has been released into the vehicle because no marking is required on the package. The probability of these types of spills occurring is unknown because little data exist due to the lack of reporting requirements.

Inspection Requirements

If all of the regulatory protections fail to prevent packaged nonhazardous materials from being tainted by hazardous materials, inspections of

nonhazardous goods for contamination could still prevent ultimate harm to the public or the environment. Aside from a DOT requirement for the inspection of unplacarded rail cars adjacent to placarded ones to detect contamination, all inspection provisions for nonhazardous materials appear to be contained in the FDA regulations. These inspections to identify tainted items are required for the ingredients, raw materials, and raw material containers for food products and for incoming shipments of components, drug product containers, and closures for pharmaceutical products and drugs for medicated animal feed. FDA regulations also require proper procedures for human or animal foodstuffs and drugs, should contamination occur. Because the term "proper procedures" is vague, however, this regulation may not provide adequate protection of public health. In addition, FDA regulations that require visual inspection of drugs for contamination might not reveal the presence of hazardous materials. Finally, because FDA regulations do not cover shipments of fibers or clothing, contamination of these nonhazardous materials may not be detected.

3.3.3 Simultaneous Package Shipments

The simultaneous shipment of packaged hazardous materials and nonhazardous goods present an obvious potential for contamination. If there is a leak of the hazardous material, the nonhazardous good may be contaminated. In contrast with sequential shipments, there is no opportunity for cleaning the vehicle between hazardous and nonhazardous shipments to avoid contamination.

Simultaneous shipment of certain materials is addressed directly in the DOT regulations. The regulations prohibit the simultaneous transportation of any package labeled as a poison and any foodstuff in the same motor vehicle (except if the packaging meets certain standards) or in the same rail car. Such regulations are important because they greatly reduce the possibility of contamination of a foodstuff by a material labeled as a poison during a simultaneous shipment. For other types of hazardous materials, compliance with FDA regulations related to inspection of foodstuffs and drugs may reveal any contamination (especially if it is apparent upon visual inspection) that may have occurred as a result of simultaneous shipment of hazardous and nonhazardous materials.

Although there are DOT regulations that require hazardous material spills to be reported, and that the contamination be contained to prevent damage to other lading, an undetected or improperly contained spill could cause significant damage. The DOT regulations, however, address a serious simultaneous transportation threat; hazardous materials bearing a poison label may not be transported in the same rail car with foodstuff, feed, or other edible material, and may only be transported in a motor vehicle with such items if the inside package is enclosed in a leaktight and dustproof overpack or metal drum. However, most hazardous materials other than poisons can be transported simultaneously with human or animal foodstuff, and poisons can be transported with nonhazardous goods other than foodstuffs that may become contaminated in the event of an accidental release.

Any leak of a packaged hazardous material that occurs during such a simultaneous shipment could result in some degree of contamination of the nonhazardous good, depending on the type of packaging used for the

nonhazardous good. If the packaging were paper or other sacks (as in the case of flour), for example, a high degree of contamination would be likely. If the packaging were glass containers (as in the case of bottled drinking water) or other impervious material such as metal, contamination would be much less likely and if contamination did occur, it probably would be less extensive. In the case of motor vehicle shipments of packages containing poisons together with foodstuffs, the poison packaging must be an overpacked liquid-tight and dust-proof container (49 CFR §177.841(e)). Thus, the potential for contamination would be greatly reduced if the packaged material were a poisonous material rather than another class of hazardous material contained in a less secure packaging. Even if contamination did occur, compliance with FDA regulations could result in detection of the contamination prior to human or animal consumption.

Exhibit 3-5 summarizes the potential regulatory gaps relevant to the joint use of vehicles.

EXHIBIT 3-5

SUMMARY OF POTENTIAL REGULATORY GAPS IN JOINT USE OF VEHICLES

- Sequential bulk shipments of hazardous and nonhazardous materials generally are not prohibited.

- Shippers of hazardous materials are not required to notify subsequent shippers (other than indirectly through placards, labels, and markings) using the same vehicle to transport nonhazardous materials of the contents of the previous load.

- The regulations generally do not prohibit simultaneous transportation of hazardous materials with foodstuffs, except in the case of poisons.

- Vehicles other than tank cars or cargo tanks carrying ORM materials are not required to be placarded, labeled, or marked.

- The regulations that require cleaning after transportation of bulk hazardous materials or after leaks from packaged hazardous materials do not contain specific decontamination standards.

- A package containing a CERCLA hazardous substance packaged in an amount less than its RQ and not meeting the requirements for a DOT hazard class is not required to be marked or labeled, because it is not a hazardous material for purposes of the DOT regulations.

CHAPTER 4

CURRENT TRANSPORTATION INDUSTRY STANDARDS AND PRACTICES

The purpose of this chapter is to characterize the transportation industry and to describe the economic factors that might induce a shipper or carrier to observe precautions against contamination. Much of the information on industry practices was obtained through an informal survey. Representatives from industry and carrier categories, trade associations, Federal, State, and local governments, and others involved in hazardous materials transportation were identified and contacted. Persons contacted for information on industry practices are included in Appendix B.

Trucking and railroading are very different and are treated separately within this chapter. For example, the size of firms varies greatly in the trucking industry, while large firms dominate the railroad industry. Further, there exists a wide range of relationships between shippers, carriers, and receivers in the trucking industry, while shippers, carriers, and receivers in the railroad industry tend to be separate and distinct entities. The railroad shipper rarely owns the track over which the shipment travels, and rail cars may be owned by a different railroad, a car leasing company, a shipper, or a receiver. In addition, industry standards for railroad shipments are more formalized than trucking industry practices.

Section 4.1 includes a description of trucking industry practices, focusing on five industrial sectors: transportation of hazardous waste, sewage sluge, chemicals, petroleum, and agricultural commodities. These transportation sectors are the focal point of this section for three reasons: (1) hazardous wastes and sewage sludge have received particular Congressional and regulatory attention; (2) petroleum and chemical truck carriers represent a significant portion of the hazardous materials transportation industry; and (3) transportation of hazardous materials poses a potential threat of contamination to agricultural commodities. Section 4.2 includes a description of railroad industry practices, and discusses formal standards that have been developed to reduce the likelihood of contamination of nonhazardous shipments. Section 4.3 includes a discussion of the economic factors that influence a carrier's decision to clean a vehicle or to dedicate a vehicle to the transportation of a particular hazardous material or class of hazardous materials. Both cleaning and dedication of a vehicle would reduce the potential for contamination of nonhazardous materials during transportation. Section 4.4 reviews statutory and common law liability and the potential effect of such liability on the behavior of different sectors of the transportation industry. Section 4.5 summarizes the findings of the chapter.

4.1 TRUCKING INDUSTRY PRACTICES

The trucking industry transports almost one billion tons of hazardous materials annually, involving almost a half million trucks. Types of carriers include private interstate carriers; large interstate common and contract

carriers; and small common, contract, and private intrastate carriers. Exhibit 4-1 distinguishes between for-hire and not-for-hire carriers in summarizing the number of trucks used in hazardous materials transportation.

The remainder of this section describes industry practices in sectors most closely related to the issue of joint use of trucks for transporting both hazardous and nonhazardous materials: hazardous waste transporters; sewage sludge transporters; chemical product transporters; petroleum transporters; and agricultural commodity transporters.

4.1.1 Hazardous Waste Transporters

Hazardous waste transporters must comply with EPA and State regulations, including manifesting requirements, and often must obtain State permits. The requirements for formal permits, certificates, and extra liability insurance often required of carriers of hazardous waste serve to limit entry of irresponsible carriers in the waste hauling business.

The hazardous waste transportation business has two components that appear to operate differently: (1) the hauling of waste from industrial processes; and (2) the hauling of contaminated soil generated during site clean-up projects. Each component is discussed briefly below.

Industrial waste transporters:

Tank trucks and roll-off boxes or roll-off tanks (similar to a dumpster), and the tractor picking up these containers, are all involved in the industrial waste transporting business. Industrial waste generators are concerned about potential liability from mishandling of the waste, and tend to select transporters carefully. The major transporters project an image of being careful, clean, and dependable. The rates charged for transporting hazardous industrial waste include the cost of an empty back haul. The potential liability for the transporter and for the generator of hazardous industrial waste provide the public with a measure of protection against contamination.

Hazardous waste cleanup:

Hazardous waste cleanup involves moving contaminated earth in dump trucks. In much of the country this business is seasonal because it is not performed when the ground is frozen. A particular company's business also fluctuates because different companies win contracts to perform site cleanups. Because contracts are competitive, hazardous waste transportation from a clean-up site is sensitive to price.

Dump trucks hauling contaminated earth are generally lined with a plastic liner that is delivered with the contaminated earth to the disposal site. The liner makes it easier to deliver the full load, and protects the truck from retaining large amounts of contaminated earth. Liner prices range from $15 to $30. Also, dump trucks usually are swept out at the disposal site because trucks must be empty or must have a manifest to leave the disposal facility.

EXHIBIT 4-1

NUMBER OF TRUCKS CARRYING HAZARDOUS MATERIALS BY INDUSTRY AND CARRIER CATEGORIES

Industry Category	Private Business Use (not-for-hire)	Motor Carrier (for-hire)	Owner Operator[2] (for-hire)	Not Classified	Total
Scrap	2,820	710	156	0	3,686
Chemical	29,550	11,205	1,926	324	43,005
Petroleum	97,637	12,537	2,685	397	113,256
Agriculture	3,379	1,970	1,002	142	6,493
Other[1]	41,872	124,364	14,258	2,362	182,856
TOTAL	175,258	150,786	20,027	3,225	349,296

*This chart includes data for trucks with a gross vehicle weight greater than or equal to 10,000 pounds.

[1]"Other" includes trucks used to haul packaged goods. Its major industry components are:

Mixed Cargo	110,765 trucks
Processed Foods	12,379 trucks
Machinery	8,220 trucks
Craftsman's Vehicles	6,779 trucks

[2]Owner/operators are generally small operations where the owner is the truck operator. In contrast, motor carriers operate fleets of trucks.

Source: 1982 Census of Transportation, "Truck Inventory and Use Survey." U.S. Department of Commerce, Bureau of the Census, September 1985.

Dump trucks involved in site cleanups are reported to be used commonly to transport scrap for recycling products made of steel, aluminum, or glass; coal; coke; lime; and, occasionally, grain. There are at least two potential ways a shipment of nonhazardous materials can become contaminated: (1) a hazardous waste transporter frequently could transport nonhazardous material; and (2) a hazardous waste transporter could transport the nonhazardous good on a seasonal basis. Of these two potential methods, the former presents the more serious problem because the frequency of occurrence is higher, and because cleaning of the truck may be less likely to occur since the cost of cleaning must be supported by the revenues from one or a few loads rather than the revenues of an entire season. The more frequent cleaning is necessary, the greater is the financial burden placed on the carrier, and the greater the probability that adequate cleaning will not occur.

Many hazardous waste transporters contacted during the course of this study felt that to transport a material such as grain in a vehicle used previously to transport hazardous wastes would present an unreasonable risk, unless the truck had been thoroughly cleaned and decontaminated. These carriers did acknowledge there is pressure to reduce rates, however, and carrying nonhazardous goods on the back haul is one way to generate additional income and keep the rates down. If the dump truck has a liner and is properly swept or cleaned after delivering the hazardous waste, the carriers stated that grain transport would probably be safe.

4.1.2 Sewage Sludge Transporters

Municipal sewage sludge disposal generally is by incineration, land application, ocean dumping, or landfilling. Landfilling is presently the dominant method of disposal, accounting for approximately 41 percent of sludge disposal.[1] Land application, defined as the spreading of sludge on or just below the surface of the land, is being promoted by many States as the sludge use/disposal option of choice. For example, Pennsylvania now requires the application of wastewater sludge to be considered as one alternative in any disturbed land reclamation plan, and New Jersey is promoting the reduction of toxic organic chemical and metal concentrations in all municipal sludges, so that they can be recycled by land application.[2] Federal regulations require stabilization of sludge prior to land application to reduce odors and lower pathogen levels (40 CFR §§257, 761).

Municipal sewage treatment sludge is transported principally from the plant to its ultimate destination in dump trucks, most frequently the large 20 to 40 cubic yard, multi-axle size, although tank trucks are used to carry

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[1]U.S. Environmental Protection Agency, "Draft Preliminary Regulatory Impact Assessment of Sludge Disposal Criteria," December 1986.

[2]U.S. Environmental Protection Agency, "Environmental Regulations and Technology: Use and Disposal of Municipal Wastewater Sludge," September 1984, EPA 625/10-84-003, p.10.

sludge with a high water content. Dump trucks carrying sludge with a substantial water content usually have sealed tailgates to prevent leakage and are covered or partially covered to prevent spillage. Many municipalities have their own trucks that carry the sludge to disposal facilities; others contract for this service. Sludge for land application is carried most frequently by a contract hauler. Although sophisticated equipment using the same vehicle is available to transport and apply the sludge, the cost of this specialized equipment is sufficiently high to limit its use. The normal sludge disposal procedure is to haul the sludge to the land application site and either dump it for later application by other equipment or transfer the sludge directly to the other equipment for application.

Sludge transportation and/or disposal is regulated closely by most States. Some States require permits to transport sludge and also require permits for land application of the sludge. The States usually must approve the land application site, as well as the rate of application of the sludge.

EPA has published guidelines on the use and disposal of municipal wastewater sludge. Under EPA guidelines, sludge from a sewage treatment plant normally would not be acceptable, without further processing, for direct food chain applications. Food chain crops are: tobacco, crops grown for human consumption, and feed for animals whose products are consumed by humans. Land application of sludge for growth of food-chain crops is subject to additional requirements, and to restraints imposed by good practices and State regulations. For example, to prevent nitrate contamination of ground water, the usual practice is to apply sludge at a rate that just satisfies the nitrogen requirement of the crop to be grown on a site. Similarly, some States protect surface waters against phosphorus contamination by limiting application rates to the phosphorus needs of the crops. Key Federal regulations affecting land application to food-chain crops focus on pathogen reduction, cadmium limitations, and PCB content.[3] Sewage sludge generally can be used directly in applications such as forestry, sod farming, and growing cotton. EPA guidelines do not address the joint-use issue, however. Testing of sludge for contaminants normally would occur at the sewage treatment plant prior to transportation, and would not identify joint-use contamination.

Even though joint-use contamination of sewage treatment sludge can occur, sludge treatment plant operators, and Federal officials contacted stated that it probably is not a significant problem. The majority of vehicles used to transport sludge are dedicated for this purpose, minimizing the potential for contamination. In addition, for instances in which contamination does occur, the amount of hazardous residue from a previous load would be diluted by the large quantity of sludge, thereby reducing the potential danger. Finally, any contamination of sludge normally would be several steps removed from human consumption.

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[3]Ibid., pp. 21-22.

4.1.3 Chemical Transporters

The review of transportation practices in the chemical industry concentrated on the transportation of chemical products from manufacturing or processing plants to customers. This activity can be a direct shipment, or can involve a transfer of cargo at a distribution center or transfer terminal for local delivery.

Chemical products can be hazardous or nonhazardous, and can be transported in bulk or packaged form. Bulk products can be solids, liquids, or gases, and are shipped most often in dry or liquid tank trucks. They also may be shipped in vans or hopper trucks. Packaged products are shipped most often in enclosed vans, but are sometimes shipped on platform or flatbed trucks. It is unlikely manufactured chemical products would be transported in dump trucks, except by customers transporting their own goods.

Most chemical firms hire trucking companies to transport their products, although some firms have their own fleets of trucks. Even those firms with dedicated fleets often augment their fleets by hiring common motor carriers during peak periods or to transport special products. Small owner/operators usually are not employed in these situations unless they work under exclusive contract to that firm.

A significant number of tank trucks are dedicated to carrying specific chemical products because of the cost of cleaning and the need for particular tank specifications. Tank trailers meeting the minimum specifications for carrying foodstuffs often are inadequate for carrying many chemical products.

Industry representatives stated that chemical manufacturers generally select carriers very carefully because they could suffer both damage to their corporate reputation and potentially large liability judgments should a contamination incident occur. Consequently, whether using one of their own vehicles or the vehicle of a common carrier, chemical manufacturers are careful to ensure trucks carrying their products are not likely to cause a contamination incident. In general, trucks are inspected to ascertain that the vehicle is clean. Some firms take samples after the truck has been loaded to ensure no contamination has occurred.

Although foodstuffs produced by chemical companies frequently are shipped in trucks used to haul hazardous chemicals, firms contacted either ensure the truck is cleaned thoroughly, or, if necessary, ban its use for certain combinations of products to eliminate any possibility of contamination.

4.1.4 Petroleum Transporters

The petroleum trucking industry is dominated by dedicated carriers. The petroleum distributor generally owns his own fleet of tractors/tank trucks and transports only petroleum products. Distributors may be large, multinational oil corporations transporting gasoline seven days a week, or local/regional firms supplying fuel oil and gasoline to homes and businesses.

Common and contract carriers often supplement the trucking fleets of the distributors. Small, independent owner/operators often provide dedicated service to the larger oil companies and supplement the company's fleet. Larger, common carriers also are used by the national, regional, and local distributors, but these carriers are more likely to sell their services to many distributors. In addition, these common carriers often are used to haul several different types of petroleum products, and to provide transportation services to industry sectors other than the petroleum industry.

Discussions with industry representatives revealed three primary reasons joint-use contamination is not a problem in the petroleum hauling industry. First, petroleum tanks are made of aluminum and are less expensive than the higher grade, corrosion-resistant, stainless steel, food and chemical tank trucks. As a result, tank trucks engaged in transporting petroleum products essentially are dedicated to that industry and would not be used to haul foodstuffs or chemicals.

Second, because of the use of ocean tankers and pipelines to deliver products to regional and local distribution terminals, the average truck delivery distance for petroleum products is less than 30 miles. This distance does not differ markedly by geographic region. Because of the small geographic scope of the market, trucks can reload quickly and there is little economic pressure on carriers to risk incompatible back hauls.

Finally, the quality control pressure on gasoline and jet fuel producers and distributors is sufficiently intense to prevent these carriers from risking a loss of reputation through the contamination of a shipment. This fear of contamination, in conjunction with the additional cleaning costs required to switch product lines, limits joint use.

4.1.5 Raw Agricultural Commodity Transporters

Possible joint-use contamination of fruits, vegetables, timber, plants, animals, grains, milk, and a variety of products made from these raw materials is a serious concern due to direct contact or consumption by humans and animals. Shippers, carriers, and receivers all have a stake in preventing or deterring transportation contamination, but one industry representative stated the prime responsibility for ensuring purity rests with the receiver of the shipment. The industry practices for transportation of certain agricultural commodities are presented below.

Fruits and Vegetables

Raw fruits and vegetables usually are transported from the farm to processing or packing plants in refrigerated vans. Except for a few loose products such as watermelons, they are carried in some form of container such as crates, plastic wrapping, or cardboard boxes. From the packing plants to the consumer outlets, refrigerated vans also are the normal transport vehicle.

Refrigerated trucks traveling long distances are used to carry agricultural products and can be used to transport non-agricultural goods, and

sometimes hazardous materials, on the back haul. These hazardous materials are contained most frequently in drums or other packages. Any spills or hazardous material package ruptures are required under DOT regulations to be cleaned up, minimizing the likelihood of contamination of fruits and vegetables transported subsequently in the vehicle.

Meat and Poultry

Animals most often are transported live to the packing plant where they are slaughtered and processed for meat or poultry products. When leaving the packing plant, these products are either frozen or packed with ice and packaged in cardboard boxes. Eggs also are transported in cardboard boxes in refrigerated vans. In some instances, animal parts may be shipped to other processing plants to make specialized products. Refrigerated trucks are always used to haul these products. According to the American Meat Institute, "hanging meat" is no longer transported.

Grains and Seeds

Grains are hauled from farms to country grain elevators in a variety of vehicles including, most frequently, the farmer's own small truck or trailer. Because the grain is frequently adulterated with foreign material, it is screened and graded upon arrival at the country grain elevators based upon the amount of damage, moisture, and foreign material content. Because of this screening procedure, trucks hauling raw grains to country elevators often are not inspected carefully.

The large hopper semi-trailer is the most common type of truck used to transport grain from the country elevator to the processing plant. At processing plants, the grain is screened and graded again, as well as visually checked for mercury or toxic contamination. Trucks picking up grains at elevators and processing plants also are visually inspected for cleanliness. Seeds are handled in a similar manner. Grains and seeds processed into liquids, such as corn syrups and sunflower oils, are then shipped in tank trucks which are typically in dedicated service.

The contamination of grain and seed products destined for animal or human consumption is possible, but does not appear to be a major concern in the industry. One grain processor representative claimed that if grain were to be mixed with any hazardous, dry substance, most likely it would be fertilizers. These fertilizers then would be separated along with other foreign substances in the screening process, or would be diluted sufficiently in processing so as to render the resulting product harmless. The veracity of this claim may depend on the toxicity of the contaminating fertilizer.

The potential for contamination of grain in trucks is somewhat limited because the majority of grain is transported in rail cars and barges, particularly for long distances. The potential for contamination is further limited by the highly seasonal nature of the industry. Fertilizers generally are not transported when grain is harvested. Fertilizers are applied in the spring and summer; the prime harvest and transport period for grain is in the

fall, although winter wheat may be harvested at times when fertilizers also are transported. Contamination also is possible during the transitional period from one season to another.

Milk and Dairy Products

Milk is transported from farms to pasteurizing or processing plants in food grade, liquid tank trucks. The milk is pasteurized and packaged in plastic or wax containers, or further processed into a number of dairy products before being packaged. Milk and other dairy products then are shipped to consumer outlets in refrigerated trucks.

Grade A milk is one of the most closely scrutinized commodities because of the Grade A Pasteurized Milk Ordinance, a voluntary participatory program established by the National Conference of Interstate Milk Shippers. All 50 States administer the program which requires:

- Interstate shippers to be approved and continuously evaluated by the States;
- Carriers to be licensed by the States;
- Tank trucks to be cleaned and sanitized to certain specifications after every load, unless reused to carry the same product within 24 hours;
- Cleaning tags that only can be removed by the next shipper;
- Testing of the pasteurized product on a random basis; and
- Retention of shipping and cleaning records for State inspectors.

Dry milk, cottage cheese, creams, and yogurt are milk products covered under the Ordinance. Ice creams and hard cheeses are not covered unless processed at a Grade A processing plant. Grade B milk is handled under a similar program.

Under the Ordinance, only a food grade (stainless steel lined) tank trailer may be used to carry milk. These trailers also are used for other liquid food products such as corn syrup and orange juice. It is possible that these tanks also could be used for carrying liquid fertilizers or pesticides so long as these chemicals do not require tanks of a higher specification. The potential for this joint use is limited, however, because of the more stringent tank specifications required for the transportation of many fertilizers, and because of the Ordinance cleaning requirements that must be met before the trailer can be reused to carry milk. Therefore, contamination of milk products is unlikely.

Conclusion

With the exception of milk, trucks used to transport agricultural products do not receive intense scrutiny. They normally are inspected visually for residues of previous loads. Even USDA inspectors have no formal procedures for inspecting trucks used to carry meat. This does not appear to be a major concern, however, because agricultural products such as fruits, vegetables, meats, and poultry are shipped in some form of container that keeps the cargo from coming in contact with the floor or walls of the truck. Furthermore, most agricultural products are transported in refrigerated trucks that are rarely, if ever, used to haul bulk hazardous materials.

While contamination of grain or animal feed in trucks used to haul agricultural chemicals might appear on the surface to represent a potential problem, few persons contacted could relate even one instance of contamination due to such joint use of trucks. The toxicology hotline staff at the University of Illinois, which received 23,000 calls on animal poisonings from all over the country last year, could not recall any incidents traced to hazardous material contamination by a transportation vehicle. However, it does not necessarily follow that this type of contamination rarely occurs. Instances of pesticide contamination may not be reported because no illness or death occurred or because of an inability to trace the cause.

4.2 RAILROAD INDUSTRY PRACTICES

A railroad uses rail cars owned by shippers, receivers, and other railroads and, therefore, often has little direct control over rail car conditions. Many railroad practices, therefore, have been formalized in the Code of Car Service Rules so that a railroad can be assured that certain standards are maintained. Relevant rules pertaining to joint use of vehicles are described below, followed by a brief description of the National Car Grade System that automatically tracks information on box cars and refrigerator cars.

4.2.1 Freight Car Service Rules

The railroad industry has created a Code of Car Service Rules to address many concerns related to the interchange of cars between carriers. In particular, two of these rules relate to car cleanliness. Car Service Rule 12 pertains to all types of rail cars, and requires that "cars containing refuse may be rejected by the receiving road when offered in interchange as empty." Car Service Rule 14 pertains exclusively to box cars and refrigerator cars, and requires that any box car or refrigerator car requiring a level of cleanliness "suitable for grain loading or better" must not be loaded with certain "contaminating commodities," or the railroad furnishing the car will be responsible for renewing the contaminated sections of the car's interior. Contaminating commodities are listed as following: animal products (hides, manure, etc.); copra (dry coconut); fish products; asphalt; creosote; lamp black, carbon black, etc.; and poisonous chemicals.

Car Service Rule 14 also lists certain other contaminating commodities that only can be loaded in such cars when authorization has been given by the car owner. These commodities include:

battery parts	insecticides
charcoal	peat or peat moss
coal and coke	tar products
acids	contaminated empty containers
grease	cottonseeds (oily or dyed)
crushed glass	molasses
graphite	oils
greasy metal products	petroleum products

4.2.2 The National Car Grade System

In 1982 the Association of American Railroads instituted the National Car Grade System, a scheme for avoiding commodity contamination by inspecting box cars and refrigerator cars used to ship the commodities listed in Car Service Rule 14. The cars carrying the contaminating commodities are identified from the waybills reported to the industry's TRAIN II central computer system, and the inspections are performed when the cars are on the repair or clean-out tracks. According to the system, cars are graded on a six-level scale with A as the best, K as the most contaminated, and U as "unfit" for any loading and in need of repair. The grade of a car depends on the last three commodities it has carried, with a distinction made between bulk and packaged shipments. Car grades can be adjusted up or down as a result of the physical inspections. A commodity code table is used to determine what grade of empty car is needed to avoid contaminating the load to be shipped.

Approximately three-fourths of the nation's box car originations in 1985 were represented in the National Car Grade System. Physical inspections were performed primarily on cars intended to be used to transport paper, bagged goods, furniture, wood pulp, peanuts, newsprint and processed food products. Approximately 5 minutes per car on the average is required for an inspection, at a cost of $4.83 per inspection. The primary benefit of the system to the railroads has been to reduce the rejection rate for empty cars delivered to shippers and found to be unfit for loading because of the risk of contamination. The Car Grade System helps to assure that nonhazardous materials are shipped in appropriate rail cars.

4.3 VEHICLE CLEANING AND DEDICATION

Two obvious means of minimizing the potential for contamination of nonhazardous materials during transportation are (1) for vehicles to be cleaned after delivering a shipment of hazardous materials, and (2) for vehicles that are used to transport hazardous materials to be dedicated to that service until the vehicle is sufficiently cleaned and purged of any contamination. The costs and economic factors that influence the industry practice of cleaning and dedicating vehicles are described below.

There are only a few regulatory requirements that relate to cleaning of vehicles after they are used to transport specific hazardous materials (e.g., poisons transported in rail cars). Many other hazardous materials, however, are transported in dedicated trucks or tank cars, effectively eliminating the potential for contamination of nonhazardous goods. To the extent that

vehicles are cleaned and dedicated, the potential for contamination of nonhazardous materials is reduced.

The costs of cleaning a vehicle such as a cargo tank include both the out-of-pocket costs of the actual cleaning process and a shorter lifespan for the vehicle, plus the opportunity cost of an idle vehicle. The price charged by a vehicle-cleaning operation varies, depending upon the type of contaminant and the type of subsequent load. Some contaminants are easier to remove than others; for example, products that permeate or stick to the walls of the tank are the most expensive to clean. In addition, some contaminant-cleaning operations generate a hazardous waste that requires proper disposal.[4]

The subsequent load to be carried by a vehicle affects the price of cleaning, because the subsequent load determines the standard of cleanliness. For example, if the subsequent load is to be food, a higher standard of cleanliness, involving different cleaning methods, may be required relative to the standard and methods required if the subsequent load will be another chemical product. Some cleaning facilities refuse to clean vehicles that are to be used to transport certain combinations of materials. Recent price estimates are presented in Exhibit 4-2, illustrating the wide range of prices charged for different types of tank cleaning. Tank cars are generally larger vehicles and cleaning costs are higher.

Tank cleaning also is costly because it shortens the lifespan of a vehicle. Cleaning tends to increase pitting and corrosion that can significantly reduce the useful life of a tank.

Finally, the opportunity cost of an idle vehicle also is an important economic factor to be considered in the cost of cleaning. A cleaning operation typically requires two to six hours, depending on the cleaning process and the number of other vehicles waiting to be cleaned. In addition, a truck cleaning facility may not be located in close proximity to the delivery or pick-up point for a particular truck, resulting in additional idle time for the vehicle. During this time, the owner or operator is unable to generate income and, unless the cleaning process is correlated closely with the truck driver's resting time, the opportunity cost could be significant. Opportunity costs for idle rail cars also may be significant.

The decision by a carrier to clean or not to clean a vehicle after delivering a load is a function of the characteristics of the residue that are present in the tank and the characteristics and value of the subsequent load. If the loads are compatible such that contamination and loss of value is not possible, then cleaning of the vehicle can be deferred.[5] The carrier's

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[4]EPA currently is studying truck cleaning facilities and the characteristics of the wastewater generated at those facilities. The Agency is considering the development of effluent guideline limitations to address water pollution problems at truck cleaning facilities.

[5]A potential problem exists when carriers are not able to judge whether or not a subsequent load is compatible with a previous load.

EXHIBIT 4-2

TANK TRAILER CLEANING COSTS

Hazardous Contaminant*/ Subsequent Load	Cost Per Cleaning (1986 dollars)
Chemical/Chemical (e.g., acrylonitrile [flammable liquid, poison] contaminant with subsequent load of denatured alcohol [flammable liquid]	$125 to $150
Chemical/Food (e.g., anti-freeze [flammable liquid] contaminant with subsequent load of corn syrup)	$250 to $500

*If the contaminant is not hazardous, the costs of cleaning are reduced significantly. For example, if a corn syrup residue must be removed to prepare the truck for molasses, the cleaning costs are about $85.

Source: Informal Industry Survey: Discussions with truck cleaners.

willingness to accept a load that requires cleaning of the vehicle after delivery is dependent, therefore, on whether the price that can be charged for the transport is sufficient to cover cleaning and opportunity costs, or whether the carrier can arrange to subsequently transport compatible loads. The likelihood of the latter depends upon the type of material being transported, the length of the trip, and the size of the market. Products that are transported in high volume, with small seasonal shifts, are most conducive to the use of dedicated vehicles. One example is gasoline and other petroleum products that are produced and transported in very high volumes in local markets; they use a dedicated fleet of tanks for such transport. Because these tanks are designed to transport only petroleum, they may be constructed of aluminum, which is less expensive than the stainless steel tanks required for other chemical and food transportation.

Use of dedicated vehicles, even temporarily, reduces the likelihood of contamination of nonhazardous materials during transportation. Because of the compatibility of subsequent loads, even for a short period of time, the cleaning costs appear to be less important to a carrier because the carrier can spread those costs over more than one trip.

One problem faced by a carrier with a dedicated vehicle is the potential for an empty back haul. A carrier is most successful when utilization of the vehicle is high. If the carrier services a small geographic market, the cost associated with any empty back haul is lower than if the carrier travels long distances between pick-ups and deliveries and thereby risks the possibility of losing several days' income between hauls. Hence, the costs of cleaning (i.e., out-of-pocket costs, shorter lifespan costs, and opportunity costs), plus the economic costs associated with empty back hauls, influence the transportation industry and increase the potential for contamination of nonhazardous materials as a result of the joint use of vehicles.

4.4 LIABILITY ISSUES

In addition to regulatory controls and formalized industry practices that are designed to decrease the risks associated with the joint transportation of hazardous and nonhazardous materials, shippers, carriers, and receivers potentially could be subject to large judgments in actions for personal injury or property damage resulting from contamination of nonhazardous goods.[6] This section discusses certain liability issues associated with joint use. These issues are addressed as follows: the basis of liability, either

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[6]This study did not identify any cases in which third parties sued and recovered damages for personal injuries arising from contamination of a shipment of nonhazardous goods by hazardous materials during transportation. In Town of East Troy v. Soo Line Railroad Co., 653 F.2d 1123 (7th Cir. 1980), however, a municipality recovered $500,000 from a rail carrier for cleanup costs and personal injury when phenol spilled from the carrier's rail car and contaminated municipal drinking water supplies. Thus, a widespread contamination incident could lead to substantial liability judgments.

statutory or common law; and the distribution of damages among multiple defendants, either apportionment or joint and several liability. The common law liability discussion includes a brief explanation of the standards of care that courts have imposed on defendants in liability actions, including negligence and strict liability. Regardless of the basis, standards of care, or division of damages among defendants, liability is an increasingly serious issue because of the recent liability insurance crisis. Virtually all insurance companies have refused to issue environmental impairment liability (EIL) policies to protect against activities associated with environmental contamination.[7]

4.4.1 Statutory Liability

Several Federal statutes impose civil and/or criminal penalties for violation of statutory provisions. Under Section 110(a) of the Hazardous Materials Transportation Act (HMTA), a party who has knowingly committed an act violating a provision of HMTA or any regulations promulgated under it is subject to a civil penalty. Maximum civil penalties are $10,000 for each violation. Each day of a continuing violation related to the shipment or transportation of a hazardous material constitutes a separate offense. Willful violations, as distinguished from knowing violations, may lead to criminal sanctions. Maximum fines for each criminal offense are $25,000 and/or imprisonment for five years under Section 110(b) of the Act. In addition, actions for equitable relief to redress a violation are provided in Section 111 of the Act. The type of violation is not specified in Section 111 and thus presumably could include unknowing violations. The basis of liability under HMTA is noncompliance with the regulations, as distinguished from any contamination that may occur as a result of noncompliance. Thus, if a shipper knowingly fails to placard or provide information on the shipping papers in violation of a DOT regulation, the shipper would be subject to a civil penalty, regardless of whether contamination occurs (as mentioned, criminal sanctions could be imposed for willful violations). In addition, under the Interstate Commerce Act (ICA), a civil action for property damage can be brought by an injured party against a carrier in a U.S. district court or a State court (49 U.S.C. §11707).

Under the Resource Conservation and Recovery Act (RCRA), criminal penalties apply to persons who knowingly transport or cause to be transported any hazardous wastes without a manifest, make a false statement or misrepresentation on a manifest, or destroy or conceal required records. In addition, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) imposes liability on carriers and persons who arrange with carriers for transport or disposal of hazardous substances. Liability can be imposed for response costs and natural resource damages resulting from release of a

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[7]Carol Cain, "Liability Capacity Growing," Business Insurance, September 22, 1986, p. 3.

hazardous substance (Section 107).[8] Section 103 of CERCLA requires that the "person in charge" of a "facility" (defined to include motor vehicles and rolling stock) immediately notify the National Response Center when there is a release to the environment of a hazardous substance in an amount equal to or greater than its reportable quantity. Section 109 of the Superfund Amendments and Reauthorization Act of 1986 (SARA) imposes criminal penalties for a knowing violation of Section 103 of CERCLA including fines of up to $250,000 or $500,000 (depending on whether the violator is an individual or organization) and imprisonment for up to three years. Section 109 of SARA also provides for civil penalties of up to $25,000 for a violation of CERCLA Section 103 reporting requirements. The RCRA, CERCLA, HMTA, and ICA civil and criminal penalty provisions provide incentives for shippers, carriers, and receivers to comply with placarding, manifest, reporting, and other regulatory requirements that could prevent harm resulting from contamination of nonhazardous goods by hazardous materials.

4.4.2 Common Law Liability

In addition to these statutory and regulatory incentives, there are various common law liability theories that could influence shippers, carriers, and receivers to take proper precautions (whether statutorily-required or not) to avoid contamination resulting from joint use. For example, if a shipper or carrier fails to exercise care and injury results, either to persons or property, he or she may be liable for the damages associated with the injury under the theory of negligence. Generally, the standard of care required is that of a reasonable person of ordinary prudence under the same or similar circumstances.

Shippers and carriers could be held liable for a contamination incident under a number of possible scenarios. A carrier might be liable if a plaintiff could show that other carriers conducted their businesses in a safer manner than did the defendant. On the other hand, if industry practice is itself careless or dangerous, adherence to such standards may not relieve the carrier of liability. In addition, a shipper might be liable for injury resulting from contamination caused by the carrier if he negligently selected or instructed the carrier or otherwise failed to minimize foreseeable risks. For example, in State v. Schenectady Chemicals, Inc., 459 N.Y.S.2d 971 (1983), the court ruled that a generator who negligently hired an incompetent transporter could be held liable for the acts of the transporter. In the context of joint use, a shipper who offers for transportation leaking canisters of hazardous waste to a carrier whose truck is also carrying sacks

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[8] In United States v. Ward, 618 F.Supp. 884 (E.D.N.C. 1985), the court held that the defendant generators were liable for response costs incurred by EPA in cleaning up roadsides where a transporter hired by the defendants had sprayed polychlorinated biphenyls (PCBs) from moving tank trucks. The court ruled that the corporate president who was personally involved in selecting the transporter was individually liable for cleanup costs under CERCLA Section 107(a)(3).

of flour may be liable for resulting injury under the theory of negligence. In this situation, the carrier might also be liable if he failed to exercise the proper degree of care to prevent the harm. This determination would be made on a case-by-case basis, considering the facts in light of common industry practice.

The basic law of negligence has been modified and extended by the courts in various States. For example, in some States violation of a safety statute (e.g., a hazardous materials transportation law) constitutes negligence as a matter of law, and in others, the violation is treated only as evidence of negligence. In addition, industry practice is affected, to a certain extent by the need to comply with the regulations governing hazardous materials transportation. As a result, the standard of care against which negligence is measured may be higher than it would be without regulation.

In a negligence action where the plaintiff as well as the defendant is negligent to some degree, the defenses of contributory or comparative fault may be raised. In the context of a joint-use problem, where the receiver sues the carrier and/or shipper to recover the economic loss of the contaminated goods (assuming no third-party personal injury action),[9] the shipper and/or carrier could claim contributory or comparative fault as a defense. In a State that recognizes contributory fault, the receiver would not be able to recover any amount from the shipper or carrier if the receiver were at fault to any degree. In a State that recognizes comparative fault, however, the receiver could recover damages from the shipper and carrier, reduced by the percentage that the receiver was found to be at fault. For example, if the court determined that the shipper was 60 percent at fault, the carrier was 30 percent at fault, and the receiver was 10 percent at fault for contamination of grain, the receiver could recover 90 percent of the decrease in value of the grain due to contamination. Contributory and comparative fault apply only to negligence actions, however, and may not be used as a defense in an action based on strict liability, which is discussed below.

Some courts have developed and applied a doctrine of strict liability for certain activities; that is, a party engaging in an "abnormally dangerous" activity may be liable for damages resulting from that activity even if the

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[9]One example of a suit for property damage as opposed to a personal injury action is International Barges, Inc. v. Kerr-McGee Corp., 579 F.2d 1204 (10th Cir. 1978). In that case, the shipper sued the carrier for the loss in market value of a bulk shipment of anhydrous ammonia that was contaminated by the residue of a previous bulk shipment of butylene. The receiver tested and refused to accept the ammonia on the basis of the butylene contamination (117 parts per million). The court awarded $29,000 to the shipper for economic loss when it could not sell the contaminated ammonia. Another example is Loan Star Cement Corp. v. Pennsylvania Railroad Co., 356 F.2d 901 (7th Cir. 1966), in which the court held that the shipper and rail carrier were each 50 percent liable for $30,000 in property damage sustained by third parties as a result of construction with cement that was contaminated in bulk transit by fragments of a previous bulk shipment of dolomite.

activity was performed in a non-negligent manner. In a strict liability action (in contrast to a negligence action) the precautions taken (e.g., placarding, manifesting, or rinsing of tanks) would not be relevant to the issues of liability and damages if, despite the precautions, a third party was injured. Thus, the threat of strict liability probably encourages more stringent safety practices than does a negligence standard because the shipper, carrier, or receiver would be subject to absolute liability if harm occurs.[10]

Certain activities related to hazardous waste disposal are considered abnormally dangerous in some States. In Branch v. Western Petroleum Inc., 657 P.2d 267 (Utah 1982), for example, the court held that ponding of water contaminated with waste oil and other chemicals on land adjacent to drinking water wells constitutes an abnormally dangerous and inappropriate use of land. In Ashland Oil, Inc. v. Miller Purchasing Co., 678 F.2d 1283 (5th Cir. 1982), the court held that injection of corrosive hazardous wastes into a crude oil pipeline is an abnormally dangerous activity. Although the court held the chemical waste disposal company that arranged for such injection strictly liable, the court applied a negligence standard to the carrier, who did not know of the hazardous character of the substance his trucks were transporting. Highway transport of gasoline was found to be abnormally dangerous in Siegler v. Kuhlman, 502 P.2d 1181 (Wash. 1972), and New Jersey courts have imposed strict liability on those who store ultrahazardous or pollutant substances: (e.g., oil in the case of City of Bridgeton v. B.P. Oil, Inc., 369 A.2d 49 (N.J. Super. 1976)).

Similarly, a court might rule that joint use of trucks for transportation of hazardous materials and foodstuffs or other consumer products (either simultaneously or sequentially) is an abnormally dangerous activity that could subject shippers and carriers to strict liability regardless of the degree of care exercised by the parties involved. There is, however, a common law exception to strict liability for common carriers. Under this exception, a common carrier would be liable only for losses resulting from some negligence on the part of the carrier. The exemption is based on the "public duty" of carriers to carry goods offered for transport.[11] Federal and State courts have varied in their approaches to this issue. Most courts have found that a carrier is not strictly liable for injuries or damages resulting from the transportation of hazardous materials.[12] Some courts, however, have

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[10]For this reason, some legal authorities recommend a strict liability standard for hazardous materials transportation. See Roberts, "Common Carriers and Risk Distribution: Absolute Liability for Transporting Hazardous Materials," 67 Ky. L.J. 441 (1978); Marten, "Regulation of the Transportation of Hazardous Materials: A Critique and a Proposal," 5 Harv. Envtl. L. Rev. 345 (1981).

[11]See Restatement (Second) of Torts §521.

[12]See, e.g., East Troy v. Soo Line R. Co., 409 F.Supp. 326 (E.D. Wis. 1976).

rejected application of the "public duty" exception to transportation of hazardous materials, reasoning that those who benefit from a dangerous activity should also bear the costs associated with the activity and that carriers can pass on liability costs to the public.[13]

A shipper who cannot be reached directly under negligence or strict liability may be responsible for the acts of others (e.g., carriers) under the doctrine of vicarious liability. In general, employers are liable for acts of employees but not for those of independent contractors. Whether a person is an employee or an independent contractor depends upon the power of control that the employer is entitled to exercise over the person in question, regardless of the existence of written contracts. To a large extent, whether the person acting under the direction of a shipper is an employee or an independent contractor is immaterial when the nature of the work being performed is abnormally dangerous. The general rule of law prevents an employer from avoiding liability by asserting that the harm was caused by the acts of an independent contractor. Injuries resulting from abnormally dangerous activities such as excavation, blasting, and demolition work are frequently handled in this manner. The same principles could conceivably be extended to the joint transportation of hazardous and nonhazardous materials. If the injury that occurs might have been anticipated as a probable consequence of the execution of work assigned to an independent contractor, the employer, as well as the contractor, may be held liable.[14]

Finally, if a government unit participates in some way as a shipper or carrier, the defense of governmental immunity from liability may be raised. Many States have completely abolished the doctrine of immunity for municipalities or counties. Other States distinguish between the performance of "governmental" functions, which are immune from suit, and "proprietary" functions, which resemble those of a private entity and are not granted immunity. This distinction might be difficult to establish if, for example, a municipality involved in solid waste collection also transported hazardous materials for a fee. Thus, the immunity of State and local governments from liability for contamination resulting from joint use is uncertain and would depend substantially on the facts of the particular case.

4.4.3 Distribution of Damages

In common law and statutory actions involving more than one defendant (e.g., a suit by an injured third party against multiple shippers of hazardous materials), a critical issue to resolve concerns the distribution of liability

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[13]See, e.g., Chavez v. Southern Pacific Transportation Co., 413 F.Supp. 1203 (E.D. Cal. 1976).

[14]Paul E. Bailey, "Liability and Insurance Aspects of Clean-Up of Uncontrolled Hazardous Waste Sites," in Proceedings of the Third National Conference on Management of Uncontrolled Hazardous Waste Sites, November 29, 1982.

and damages among defendants. If the degree to which each defendant caused the plaintiff's injury can be readily divided among defendants, courts will assess damages accordingly. In some cases, however, it is not possible to apportion liability and damages among defendants. For example, in the classic case of Summers v. Tice, 199 P.2d 1 (Cal. 1948), the plaintiff was struck by a single bullet when two hunters fired in his direction, but was unable to prove which defendant had caused the injury. The court held that in this situation, the burden was on the defendants to show that they did not cause the injury; if they cannot meet this burden, the defendants must share liability "jointly and severally." Thus, application of joint and several liability can result in imposition of liability for the full amount of the plaintiff's injuries on a single defendant, even though there may be any number of defendants involved. In CERCLA injunctive and cost recovery actions, courts have consistently held that joint and several liability applies where the harm cannot be divided among the defendants.[15]

In City of Perth Amboy v. Madison Industries, 13 Envtl. L. Rep. 20554 (N.J. Super. 1983), one defendant discharged heavy metals and the other discharged organic compounds into a city drinking water supply. The court imposed joint and several liability on the two defendants, holding that the harm was indivisible because the acts of either defendant alone would have been sufficient to contaminate the watershed as a source of drinking water. Thus, joint and several liability could apply where shipper A and shipper B each contribute an unknown quantity of different liquid wastes to a tank truck that is subsequently used to transport nonhazardous goods. Even if shipper A claims to have contributed only a small amount[16] of a 20,000 gallon shipment, the court may nevertheless hold shipper A liable for the full amount of the damages because either shipper's waste alone could have caused the contamination and resulting injury.[17] Shipper A could then bring a separate action for "contribution" against shipper B. Under the theory of contribution, a defendant against whom a judgment is rendered for the full amount of the plaintiff's injury may recover portions of the judgment from others who were jointly responsible for the injury. Approximately 80 percent

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[15]See, e.g., United States v. Conservation Chemical Co., 619 F.Supp. 162 (W.D. Mo. 1985).

[16]Courts may apply a "de minimis" rule, however, to avoid grossly unjust results. Thus, if shipper A contributed only one gallon of the waste, the court probably would not impose all liability on shipper A.

[17]Because of the potential for such results, some States have begun to eliminate or restrict joint and several liability as part of an effort to reform tort law. For example, Colorado has eliminated the joint and several liability doctrine entirely and California has eliminated the doctrine in suits for noneconomic damages. See "Selected State Legislative Action Re: Affordability and Availability of Liability Insurance," National Conference of State Legislatures, March 10, 1986.

of the States have recognized a right of contribution where joint and several liability exists.[18]

In sum, potential statutory liability may enhance shippers', carriers', and receivers' compliance with regulations related to joint use of vehicles for transportation of hazardous materials and nonhazardous goods. In addition, the threat of common law liability may cause shippers, carriers, and receivers to take further precautions, not required by statutes or regulations.

4.5 SUMMARY OF CURRENT STANDARDS AND PRACTICES

Transportation of chemicals and hazardous wastes occurs in the same type of vehicles as transportation of certain types of agricultural commodities. It is possible, therefore, that contamination of nonhazardous materials can occur during transportation. That joint use of vehicles occurs, however, is not a sufficient basis for concluding that contamination of nonhazardous materials is likely to occur. Shippers, carriers, and receivers are motivated to take precautions against the possibility of contamination to preserve the value of nonhazardous shipments and to reduce the potential for liability claims. Precautions such as vehicle cleaning after delivery of hazardous materials can be costly, however, and carriers may try to spread those costs over several, similar shipments, while attempting at the same time to minimize the number of empty back hauls.

In times of economic downturn, there is an increased likelihood that carriers may attempt to reduce costs by reducing the number of vehicle cleanings or by risking a subsequent haul of materials that are not optimally compatible with the previous load. There is no evidence, however, indicating whether this has or has not occurred. Shippers, carriers, and receivers, generally, are concerned about contamination of shipments as evidenced by certain formalized industry practices that have been established to ensure cleanliness and prevent contamination of nonhazardous materials.

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[18]See United States v. Conservation Chemical Co., 619 F.Supp. 162 (W.D. Mo. 1985).

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This Report to Congress is the result of a study on the joint use of vehicles for transportation of both hazardous and nonhazardous materials. During the study, the Agency attempted to assess the extent of such joint use and to evaluate the protection offered the public by current regulatory requirements and industry practices. A summary of these evaluations is presented below, and is followed by the Agency's recommendations, which are based on the conclusions drawn from this study.

5.1 EXTENT OF THE JOINT-USE PROBLEM

Little data exist on the extent to which vehicles are used to transport both hazardous and nonhazardous materials. General statistics collected by the Bureau of the Census and the Department of Transportation indicate that in the United States almost a billion tons of hazardous materials are transported annually by truck and 73 million tons by rail. Although most of the 460 thousand trucks used to transport hazardous materials also are used to transport nonhazardous goods, about 97 percent of all commercial trucks never carry hazardous materials. Further, about 70 percent of the trucks that do carry hazardous materials carry only packaged hazardous materials, where existing regulations provide substantial protection. Ninety percent of the hazardous material tonnage transported by rail is carried in tank cars where dedication or cleaning is common.

In spite of a broad search for incidents, over a 30-year period only 18 documented cases of transportation-related contamination of nonhazardous goods by hazardous materials were identified. Of these 18 cases, only 6 incidents occurred in the United States. Five additional undocumented incidents were described by people contacted during the study. The small number of incidents identified in this study suggest that joint-use contamination is not a significant problem.

There are reasons to believe, however, that not all joint-use contamination incidents are discovered due to the difficulty in identifying the source of contamination or because the consequences of contamination are not evident immediately. Consequently, while the evidence evaluated to date indicates that the problem of joint-use contamination is minor, such evidence is not conclusive.

5.2 CURRENT REGULATIONS AND INDUSTRY PRACTICES

DOT regulations requiring spills of hazardous materials to be reported and contained offer substantial protection from contamination of goods resulting from spills of packaged hazardous materials. The DOT regulations that prohibit the simultaneous shipment of poisons and food in rail cars increase

this protection in an area where the consequences of joint-use contamination could be most severe. DOT regulations allow trucks to carry poisons and food simultaneously only if the poisons are packaged more securely than is required for other materials, thereby providing extra protection against food contamination by poisons in trucks as well. Together with the CERCLA hazardous substance release reporting requirements and the FDA requirements for inspection of foodstuffs and drugs, existing regulations appear to substantially protect against the consequences of contamination of goods (especially foodstuffs) by spills of packaged hazardous contaminants.

Existing regulations do not offer complete protection from contamination for goods hauled in bulk. Rail cars carrying poisons must be cleaned after such use. Trucks and rail cars carrying radioactive materials must be decontaminated. Trucks carrying arsenical compounds must be cleaned. For the wide range of remaining hazardous materials transported in bulk, however, no cleaning regulations exist and joint-use contamination could result. Placarding and marking requirements may provide the shipper with an indication of what was carried previously in the vehicle but these regulations were instituted to protect against other dangers and may not be a consistent, reliable method of informing shippers of the potential danger involved in loading the bulk vehicles with nonhazardous goods.

In addition to Federal and State regulations, however, there are economic and legal incentives that encourage shippers, carriers, and receivers to take precautions to prevent contamination. First, the value of most goods is greatly reduced by contamination. This possibility encourages the shipper to be very particular about the cleanliness of the vehicle into which the product is loaded and encourages the receiver to check the purity of goods received. Shippers often establish cleanliness standards, either formally or informally, to ensure the integrity of their product. For example, shippers of Grade A pasteurized milk and milk products established the Grade A Pasteurized Milk Ordinance to maintain cleanliness and purity standards, and the Association of American Railroads instituted the National Car Grade System to formally rate rail cars for suitability to carry different types of nonhazardous lading. Cleanliness is an important part of the carrier's service quality, because shippers and receivers are concerned about the purity of their products.

Second, the threat of liability claims may lead the shipper, carrier, and receiver to exercise safety precautions beyond those required by regulation to avoid such claims. Statutory liability provisions under HMTA, RCRA, and CERCLA further increase the threat of liability to businesses dealing with hazardous materials, hazardous wastes, and hazardous substances. Liability claims also may result in increased insurance premiums or an inability to obtain insurance in the future.

Finally, the desire to maintain a positive corporate image is an incentive for good industry practices, as one contamination incident can gravely damage a corporate reputation and jeopardize future business.

In spite of these important deterrents to contamination, industry sources emphasized there is a wide range of practices related to the level of care

exercised to avoid contamination by shippers, carriers, and receivers. Many sources mentioned the competitive pressures within the trucking industry as a factor that might contribute to joint-use contamination. Because avoiding empty back hauls and expensive cleaning procedures are obvious ways to reduce costs, these pressures may increase the potential for contamination incidents.

The other concern mentioned by industry sources was the great diversity in size among companies in the carrier industry and the relative stake each company has in continued operation. A large trucking company may have assets of hundreds of millions of dollars while an owner-operator may not have the money for fuel on the back haul. These companies probably view the consequences of contamination quite differently. Although the likelihood of contamination appears quite small, according to industry representatives, circumstances that are most likely to result in contamination would involve marginally viable carriers hauling low-value goods in rate-sensitive markets.

5.3 RECOMMENDATIONS

Because of the small number of joint-use contamination incidents reported in the United States and the existing regulatory and nonregulatory incentives to minimize or avoid contamination, it is difficult at this time to recommend a complete prohibition of the joint use of vehicles. DOT, EPA, and FDA regulations provide safeguards that reduce the risk of joint-use contamination and the threat to public health and the environment. The Agency also is not recommending at this time further study of the joint-use issue. Although further research may uncover additional incidents of joint-use contamination, the Agency believes that further study will not alter the fundamental conclusion of this report that joint use of vehicles to transport hazardous and nonhazardous materials is not a significant problem.

Any revisiting of the joint-use issue in the future should begin with additional study in the following areas:

- Research in greater detail the joint-use problem with respect to the transportation of sewage sludge to determine its nature and scope. Such an effort, if undertaken, could include an examination of EPA Regional and State data pertaining to sludge transportation.

- Determine with greater precision the frequency of transportation-related contamination relative to all contamination incidents. This effort could involve follow-up investigations of contamination incidents identified by State health and agricultural organizations, as well as other Federal data sources.

Insufficient information exists at this time to recommend that "special safeguards should be taken to minimize threats to public health and the environment" caused by joint-use contamination incidents (SARA Section 118(j)(1)(B)). While the Agency does not recommend any additional studies at this time, the Agency recognizes that the scope of this study was limited.

However, in the course of conducting this study, the Agency identified the following potential areas that could be considered as part of any subsequent review of this issue:

- Examine the need for requiring carriers to inform shippers that the previous shipment contained hazardous materials, and whether and how the nondedicated vehicle was cleaned.

- Examine the extent to which generic decontamination standards and/or substance-specific decontamination standards may be needed for substances of greatest concern that might pose a high risk, such as pesticides contaminating food and fiber products.

- Examine the extension of marking regulations applicable currently to tank cars and cargo tanks to other bulk vehicles, particularly dump trucks. (DOT is presently considering such a regulation.)

- Examine the need for requiring additional protection or prohibit the simultaneous transportation of foodstuffs and nonpoisonous, hazardous materials that exhibit harmful characteristics (e.g., potential carcinogenicity and chronic toxicity). Such an approach would be similar to the existing DOT regulations for poisons in trucks and rail cars.

- Examine the need for requiring liners for certain vehicles such as dump trucks when transporting hazardous materials.

- Examine the need for prohibiting inadequate or insufficient cleaning procedures that may contribute to improper disposal of hazardous contaminants or may pose a threat to a subsequent shipment of nonhazardous goods.

- Encourage the growth of the truck and rail car cleaning industries to promote better cleaning practices to reduce the likelihood of contamination, especially during the back haul.

Finally, the following two areas were considered to be beyond the scope of this study: joint use of vessels (i.e., watercraft) to transport hazardous and nonhazardous materials, and the effectiveness of compliance with and enforcement of existing regulations.

The study focused on the joint use of motor vehicles and rail cars and did not examine potential problems associated with transportation of hazardous and nonhazardous materials in vessels. The more narrow focus of the study seemed to better reflect Congressional intent. However, 35 percent of hazardous

materials is transported on water, and several of the contamination incidents identified in this study involved simultaneous transportation of hazardous and nonhazardous materials on ships.

The study also did not focus on compliance with or enforcement of existing regulations; it examined the joint-use issue assuming full compliance. Several of the incidents identified in the study, however, involve improperly cleaned spills. It may be appropriate, therefore, to address whether increased compliance and enforcement would be more fruitful in eliminating potential joint-use incidents, rather than additional regulation.

GLOSSARY AND ACRONYMS

Bulk packaging -- a reusable bulk container. In general, the dividing line between small (nonbulk) and bulk packagings is 110 gallons or 1000 pounds. Bulk packagings include cargo tanks and tank cars.

Carrier -- a person engaged in the transportation of passengers or property. See 49 CFR §171.8. Private carriers transport commodities that they own and the transport is integral to their business. Common carriers are transporters of freight for compensation; common carriers must accept all traffic tendered to them that is within their operating authority (to the extent that they have equipment and drivers to do so). Contract carriers are transporters of freight by motor vehicle for compensation in the exclusive service to one or more specific shipper(s) as authorized by duly constituted Federal or State authority. This classification includes owner-operators under long-term lease to certified carriers.

Cargo tank -- any tank permanently attached to or forming a part of any motor vehicle or any bulk liquid or compressed gas packaging not permanently attached to any motor vehicle which by reason of its size, construction, or attachment to a motor vehicle, is loaded or unloaded without being removed from the motor vehicle. See 49 CFR §171.8. Such tank trucks are the main carriers of bulk hazardous materials over roads.

CERCLA -- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC §9601 et seq.).

CFR -- Code of Federal Regulations, a document containing all finalized regulations.

Chassis container trailer -- a semitrailer chassis designed especially to transport one or two containers over the highway.

DOT -- Department of Transportation.

Dropframe van -- a van design employing one offset or drop in the cargo deck immediately behind the supports.

Dump truck -- a truck that can be tilted to discharge its load by gravity.

EPA -- Environmental Protection Agency.

FDA -- Food and Drug Administration.

FHWA -- Federal Highway Administration of the U.S. Department of Transportation.

FIFRA -- Federal Insecticide, Fungicide, and Rodenticide Act (7 USC 136 et seq.).

Flatbed truck -- see platform truck.

FRA -- Federal Railroad Administration of the U.S. Department of Transportation.

Freight container -- a reusable container having a volume of 64 cubic feet or more, designed and constructed to permit being lifted with its contents intact and intended primarily for containment of packages (in unit form) during transportation. See 49 CFR §171.8.

Grain truck -- a low-side, open-top truck designed primarily to transport dry, fluid commodities.

Hazardous material -- a substance or material, including a hazardous substance, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. See 49 CFR §171.8. Some hazardous materials are listed in the Table and Appendix to 49 CFR §172.101; other materials must be evaluated against the criteria for DOT hazard classes (see Exhibit 3-2).

Hazardous substance (DOT regulations) -- a material, including its mixtures and solutions, that:

(1) Is listed in the Appendix to 49 CFR §172.101;

(2) Is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the Appendix to §172.101; and

(3) When in a mixture or solution, is in a concentration by weight which equals or exceeds the concentration corresponding to the RQ of the material, as shown in the following table:

RQ Pounds (kilograms)	Concentration by Weight Percent	PPM
5000 (2270)	10	100,000
1000 (454)	2	20,000
100 (45.4)	0.2	2,000
10 (4.54)	0.02	200
1 (0.454)	0.002	20

See 40 CFR §171.8. The Appendix to 49 CFR §172.101 lists materials listed or designated as hazardous substances under CERCLA

Hazardous substance (CERCLA) -- (A) any substance designated pursuant to section 311(b)(2)(A) of the Federal Water Pollution Control Act, (B) any element, compound, mixture, solution, or substance designated pursuant to

section 102 of CERCLA, (C) any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress), (D) any toxic pollutant listed under section 307(a) of the Federal Water Pollution Control Act, (E) any hazardous air pollutant listed under section 112 of the Clean Air Act, and (F) any imminently hazardous chemical substance or mixture with respect to which the Administrator has taken action pursuant to section 7 of the Toxic Substances Control Act. The term does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquified natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). See CERCLA Section 101(14).

Hazardous waste (DOT regulations) -- any material that is subject to the Hazardous Waste Manifest Requirements of the U.S. Environmental Protection Agency specified in 40 CFR Part 262. See 49 CFR §171.8.

Hazardous waste (RCRA) -- a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics, may:

> (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
>
> (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

See RCRA Section 1004(5).

HMTA -- Hazardous Materials Transportation Act of 1975 (49 USC §1801 et seq.).

Insulated refrigerated van -- a van designed to possess specific thermal properties and using a self-contained refrigeration system.

Joint and several liability -- civil liability for an act or omission where each liable party is liable for the full amount of damages.

Manifest system -- under RCRA, the system used for identifying the quantity, composition, origin, routing, destination, and ultimate disposition of hazardous waste during its transportation from generation to disposal, treatment, or storage.

Marking -- applying the descriptive name, instructions, cautions, weight, or specification marks or combination thereof required by DOT regulations to be placed upon outside containers of hazardous materials offered for transport. See 49 CFR §171.8.

Mixture -- a material composed of more than one chemical compound or element. See 49 CFR §171.8.

Mode -- any of the following transportation methods: rail, highway, air, or water. See 49 CFR §171.8.

Motor vehicle -- a vehicle, machine, tractor, trailer, or semitrailer, or any combination thereof, propelled or drawn by mechanical power and used upon the highways in the transportation of passengers or property. It does not include a vehicle, locomotive, or car operated exclusively on a rail or rails, or a trolley bus operated by electric power derived from a fixed overhead wire, furnishing local passenger transportation similar to street-railway service. See 49 CFR §171.8.

Multi-stop delivery truck -- a truck with the driver's compartment and controls located at the extreme front of the vehicle and designed with an integral driver and cargo compartment.

NRC -- National Response Center

NRC -- Nuclear Regulatory Commission.

Oilfield truck -- a flatbed equipped with a pick-up loop at the front to allow the nose of the trailer to be lowered to the ground for loading or unloading.

Open top van -- a truck with closed sides and ends.

ORM -- Other regulated materials. Materials that do not meet the definition of the other hazard classes. See Exhibit 3-2.

Package delivery truck -- a motor truck designed with an integral driver and cargo compartment.

Packaging -- the assembly of one or more containers and any other components necessary to assure compliance with the minimum packaging requirements of DOT regulations; includes containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank car tanks. See 49 CFR §171.8.

Pick-up truck -- a small, open truck.

Platform truck -- a truck with a floor but no sides or roof.

Poisonous materials -- according to the degree of hazard in transportation, materials classified as Poison A, Poison B, and Irritating Material. See the DOT hazard classes in Exhibit 3-2.

Portable tank -- any packaging (except a cylinder having a 1000-pound or less water capacity) over 110 U.S. gallons capacity and designed primarily to be loaded into, loaded on, or temporarily attached to a transport vehicle or

ship, and equipped with skids, mounting, or accessories to facilitate handling of the tank by mechanical means. It does not include any cargo tank, tank car tank, tank of the DOT-106A or 110A type, or trailers carrying 3AX, 3AAX, or 3T cylinders. See 49 CFR §171.8.

Rail freight car -- a car designed to carry freight or non-passenger personnel by rail, and includes a box car, flat car, gondola car, hopper car, tank car, and occupied caboose. See 49 CFR §171.8.

RCRA -- Resource Conservation and Recovery Act of 1976 (41 USC §6901 et seq.).

Reportable quantity (RQ) -- the amount of a CERCLA hazardous substance that, if released into the environment, must be reported immediately to the National Response Center. See 40 CFR §302.4.

Residue -- the hazardous material remaining in a packaging, including a tank car, after its contents have been unloaded to the maximum extent practicable and before the packaging is either refilled or cleaned of hazardous material and purged to remove any potential hazardous vapors. See 49 CFR §171.8.

RSPA -- Research and Special Programs Administration of the U.S. Department of Transportation.

SARA -- Superfund Amendments and Reauthorization Act of 1986 (P.L. No. 99-499).

Shipping paper -- a shipping order, bill of lading, manifest or other shipping document serving a similar purpose and containing the information required by 49 CFR §§172.202, 172.203, and 172.204. See 49 CFR §171.8.

Sludge -- solid, semi-solid, or liquid waste generated from a wastewater treatment plant, exclusive of the treated effluent from the plant.

Solid waste -- garbage, refuse, sludges, and other discarded solid materials resulting from industrial and commercial operations and from community activities. It does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluents, dissolved materials in irrigation return flows or other common water pollutants. See 40 CFR §241.101(v).

Strict liability -- civil liability for an act or omission in which fault is irrelevant; if the defendant's conduct resulted in harm, he is liable regardless of whether he was negligent.

Tank car -- a type of rail car used to transport liquids or gases. About 80 percent of annual rail shipments of hazardous materials involve tank cars.

Tank truck (cargo tank) -- a truck used to transport liquids or gases.

TOFC -- trailer on flatcar (piggyback).

Transport vehicle -- a cargo-carrying vehicle such as an automobile, van, tractor, truck, semitrailer, tank car or rail car used for the transportation of cargo by any mode. Each cargo-carrying body (trailer, rail car, etc.) is a separate transport vehicle. See 49 CFR §171.8.

TSCA -- Toxic Substances Control Act (15 USC §2601 et seq.).

Van -- a type of closed truck for carrying freight; often operated by for-hire carriers transporting hazardous materials only part of the time.

APPENDIX A

REGULATIONS RELEVANT TO THE JOINT USE OF TRUCKS

DOT Regulations

49 CFR §171.1(a)(3)

The DOT hazardous materials regulations, including those referenced in the remainder of this appendix, do not govern the intrastate transportation of hazardous materials by motor vehicles, unless the materials are hazardous wastes, hazardous substances, or flammable cryogenic liquids in portable tanks and cargo tanks.

49 CFR §171.3(b)

"No person may accept for transportation, transport, or deliver a hazardous waste for which a manifest is required unless the person ... [d]elivers, as designated on the manifest by the generator, the entire quantity of the waste ..." to the designated recipient.

49 CFR §171.8

A "hazardous substance," as defined by section 101(14) of CERCLA, is not defined as a "hazardous substance" by DOT, and therefore is exempt from DOT's hazardous materials regulations, unless it "[i]s in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the ..." regulations.

49 CFR §171.15

"At the earliest practicable moment, each carrier who transports hazardous materials (including hazardous wastes) ... [must give notice by telephone to DOT] after each incident that occurs during the course of transportation (including loading, unloading and temporary storage) in which as a direct result of hazardous materials:

(1) A person is killed;
(2) A person receives injuries requiring his hospitalization;
(3) Estimated carrier or other property damage exceeds $50,000;
(4) Fire, breakage, spillage, or suspected radioactive contamination occurs involving shipment of radioactive material ...;
(5) Fire, breakage, spillage, or suspected contamination occurs involving shipment of etiologic agents; or
(6) A situation exists of such a nature that, in the judgment of the carrier, it should be reported ..., e.g., a continuing danger to life exists at the scene of the incident."

49 CFR §171.15

"Each carrier who transports hazardous materials shall report in writing ... [to DOT] within 15 days of the date of discovery, each incident that occurs during the course of transportation (including loading, unloading, or temporary storage) in which, as a result of the hazardous materials,

any of the circumstances set forth in §171.15(a) occurs or there has been an unintentional release of hazardous materials from a package (including a tank) or any quantity of hazardous waste has been discharged during transportation ...."

49 CFR §172.101

"The Hazardous Materials Table (Table) in this section designates the materials listed therein as hazardous materials for the purpose of transportation of those materials in commerce. The Table identifies the class of each listed material, and specifies or references requirements ... pertaining to its packaging, labeling, and transportation. However, those references do not include other requirements having general applicability such as those specified in Parts 171 and 172, and Subparts A and B of Part 173 ...."

49 CFR §172.200(a)

With certain exceptions, all persons offering hazardous material for transportation must describe the hazardous material on the shipping paper.

49 CFR §172.201(a)(1)

When a hazardous material and a material not regulated as a hazardous material are described on the same shipping paper, the presence of the hazardous material must be clearly noted.

49 CFR §172.203(e)(1)

"The description on the shipping paper for a packaging containing the residue of a hazardous material may include the words 'RESIDUE: Last Contained * * *' and the letters 'RQ' must be entered on the shipping paper either before or after the basic description."

49 CFR §172.203(g)(1)

"The shipping paper for a rail car containing a hazardous material must contain the notation 'Placarded' followed by the name of the placard required for the rail car."

49 CFR §172.300(a)

"Each person who offers a hazardous material for transportation shall mark each ... [packaging or container] containing the hazardous materials in the manner required ... [in the marking requirements]."

49 CFR §§172.326(e), 172.328(f), and 172.330(g)

"[Each cargo tank, portable tank, multi-unit tank car tank and tank car (except when it contains a combustible liquid)] must remain marked ... [as containing a hazardous material when empty] unless ... [it is (1) reloaded] with a material not subject to ... [hazardous materials regulations], or (2) [s]ufficiently cleaned of residue and purged of vapor to remove any potential hazard."

49 CFR §§172.326(b), 172.328(e), and 172.330(d)

"A ... [cargo tank, tank car, or multi-unit tank car tank] marked with the ... [name or identification number] of a hazardous material may not be

used to transport any other material unless the marking is removed, or changed to identify the hazardous material in the [tank] ...."

49 CFR §172.400

With certain exceptions, any person offering a package or container containing a hazardous material for transportation shall label it, when required, with labels prescribed for the material. A label is not required on packages containing ORM materials.

49 CFR §172.500(a)

"Each person who offers for transportation or transports any hazardous material shall comply with the applicable placarding requirements ...." Placarding is not required for etiological agents, ORM materials, and materials authorized to be offered as limited quantities.

49 CFR §172.504(c)

"When the gross weight of ... [certain hazardous materials] is less than 1000 pounds, no placard is required on a motor vehicle, rail car, or freight container .... This paragraph does not apply to portable tanks, cargo tanks, tank cars, ..."

49 CFR §172.506(a)

"Each person offering a motor carrier a hazardous material for transportation by highway shall provide to the motor carrier the required placards for the material being offered prior to or at the same time the material is offered for transportation ...."

49 CFR §172.508

Each person offering a hazardous material for transportation by rail must affix to the rail car containing the hazardous material an appropriate placard.

49 CFR §172.510(c)

"Each tank car containing the residue of a hazardous material must be placarded with the appropriate RESIDUE placards ... that correspond to the placard that was required for the material the tank car last contained when loaded unless the tank car -- (1) Is reloaded with a material requiring no placards or different placards or (2) Is sufficiently cleaned of residue and purged of vapor to remove any potential hazard."

49 CFR §172.514(a)

"Each cargo tank and portable tank that is required to be placarded when it contains a hazardous material must remain placarded when it is emptied unless it is: (1) [r]eloaded with a material not subject to ... [hazardous material regulations] or (2) [s]ufficiently cleaned and purged of vapors to remove any potential hazard."

49 CFR §173.4(a)

"Small quantities of Flammable liquids, Flammable solids, Oxidizers, Organic peroxides, Corrosive materials, Poison B, and ORM A, B, C and Radioactive materials that alos meet the definition of one or more of

these hazard classes are not subject to any other requirements of ... [the hazardous materials regulations under certain conditions]."

49 CFR §§173.25(c) and 174.841(e)

"A carrier may not transport a package bearing a poison label in the same motor vehicle with material that is marked as or known to be foodstuff, feed, or any edible material intended for consumption by human or animals," unless the packaging meets certain standards.

49 CFR §§173.28(h), (m), (n)

"Except [when used to carry corrosive solids, ORM-A, B, C, or E materials or when used to carry corrosive liquids, flammable liquids, flammable solids, organic peroxides, oxidizers, poisons, or radioactive materials and thoroughly inspected to remove all residues, inspected for deterioration, and returned to its original shape] ... single trip containers ... and nonreusable containers ... from which contents have been removed following use for transportation of any material, may not be used thereafter for the transportation of hazardous materials."

49 CFR §173.28(i)

"Polyethylene packagings previously used for poisonous materials should not be reused for any materials other than poisonous materials or hazardous wastes."

49 CFR §§173.29(a) and 173.29(c)

Unless it has been cleaned and purged of all residue, or unless it is filled with a material that is not subject to DOT hazardous materials regulations, a packaging having a capacity of 110 gallons or less or a tank that previously contained a hazardous material may not be offered for transportation unless offered in the same manner as required when it previously contained a greater quantity of hazardous material.

49 CFR §§173.119(a)(17)(iii) and 173.119(e)(3)(v)

"Necessary interior cleaning of cargo tanks must be performed between changes in lading ..." when the cargo tanks are carriers of a flammable liquid with a flash point of 20 degrees Fahrenheit or below and with a vapor pressure not over 27 pounds per square inch, absolute, at 100 degrees Fahrenheit.

49 CFR §173.190(b)(3)

After unloading from a tank car white or yelloe phosphorus packed in water, the person who unloaded it must fill it completely with an inert gas or more than halfway to its dome's capacity with water or no more than 140 degrees Fahrenheit. "Before the car is offered for return movement, it must be placarded with FLAMMABLE SOLID RESIDUE placards ...."

49 CFR §173.368

"Arsenic dust, arsenical flue dust, and other poisonous noncombustible byproduct dusts from metal recovery operations not subject to dangerous spontaneous heating, and arsenic trioxide, calcium arsenate, or sodium arsenate ... [may] be shipped in bulk in ... [certain] transport vehicles,

if those transport vehicles are assigned exclusively to this type of service ...." "Transport vehicles assigned exclusively to this service must be marked 'ARSENICAL SERVICE ONLY', ..."

49 CFR §174.8(b)

"At any point where a train is required to be inspected, each loaded placarded rail car and each rail immediately adjacent thereto must be inspected. The cars may continue in transit only when the inspection indicates that the cars are in a safe condition for transportation .... The inspection of a rail car other than a tank car or a rail car containing Class A explosives must include a visual inspection for obvious defects of the running gear and any leakage of contents from the car and to determine whether all required placards are in place ...."

49 CFR §174.10(d)

"A car containing packages of hazardous materials other than explosives may not be offered in interchange if the packages are in a leaking condition."

49 CFR §174.25(c)

"The shipping paper for a tank car that contains only the residue of a hazardous material must contain the words 'RESIDUE: Last Contained * * *', followed by the basic description of the hazardous material last contained in the tank car and the ... [appropriate placard notation] followed by the word 'RESIDUE'." "For a tank car that contains a residue that is a hazardous substance, the letters 'RQ' must also be entered on the shipping paper either before or after the basic description."

49 CFR §174.48(b)

See 49 CFR §117.854(c)(2).

49 CFR §174.57

"All hazardous material which has leaked from a package in any rail car or on other railroad property must be carefully removed."

49 CFR §174.69

"When lading requiring placards or car certificates is removed from a rail car other than a tank car, each placard and car certificate must be removed by the person unloading the car. For a tank car which contained a hazardous material, the person responsible for removing the lading must assure ... that the tank car is properly placarded for any residue which remains in the tank car."

49 CFR §§174.81(f), 177.848(f)

Describe hazardous materials that may not be loaded, transported, or stored together.

49 CFR §174.103(c)(1)

Packages of explosives showing evidence of leakage of liquid ingredients must be "refused if leakage is discovered before acceptance."

49 CFR §§174.280, 174.380, 174.480, and 174.680

"A carrier may not transport any package of ... [flammable liquid, or gaseous, oxidizer, or flammable solid material or any other material] bearing a poison label in the same [rail] car with material which is marked as or known to be ... [foodstuff], feed, or any other edible material intended for consumption by humans or animals."

49 CFR §174.515

"After potassium permanganate is unloaded from a rail car, the car must be thoroughly cleaned unless the car is used exclusively in the carriage of potassium permanganate."

49 CFR §174.615

"A rail car which has contained ... [poisonous materials] which show any evidence of leakage from packages, must be thoroughly cleaned after unloading before the car is returned to service." "After poisonous materials are unloaded from a rail car, that car must be thoroughly cleaned unless the car is used exclusively in the carriage of poisonous materials."

49 CFR §177.817(c)

"A motor carrier shall mark on the shipping paper ..., if it offers or delivers a freight container or transport vehicle to a rail carrier for further transportation; (1) A description of the freight container or transport vehicle; and (2) The kind of placard affixed to the freight container or transport vehicle."

49 CFR §177.821

"Any individual container used for the transportation of liquid nitroglycerin, desensitized liquid nitroglycerin or diethylene glycol dinitrate, or any boot oused therewith, found in suh a condition as to permit leakage, shall be discarded and shall not thereafter be repaired for further use .... Should any package of high explosive when offered for shipment show excessive dampness or be moldy or show outward signs of any oily stain or other indication that absorption of the liquid part of the explosive is not perfect, or that the amount of the liquid part is greater than the absorbent can carry, the package must be refused in every instance. The shipper must substantiate any claim that a stain is due to contact with material other than the liquid explosive ingredient of the explosive. In case of doubt, the package must be rejected ...."

49 CFR §177.841(a)(2)

Before any motor vehicle may be used for transporting any other articles, all detectable traces of arsenical materials must be removed therefrom by flushing with water, or by other appropriate method ...."

49 CFR §841(e)

See 49 CFR §173.25(c).

49 CFR §§177.854(c)(2); (d)(2); 174.48(b)
"The repair of the package must be adequate to prevent contamination of or hazardous admixture with other lading transported on the same motor vehicle therewith." "Packages of hazardous materials that are damaged or found leaking during transportation, and hazardous materials that have spilled or leaked during transportation, may be forwarded to destination or returned to the shipper in a salvage drum ...."

49 CFR §177.855
Provisions for accidents involving explosives.

49 CFR §177.856
Provisions for accidents involving flammable liquids.

49 CFR §177.857
Provisions for accidents involving solids or oxidizing materials.

49 CFR §177.859
Provisions for accidents involving compressed gas.

49 CFR §177.860
Provisions for accidents involving poisons. "A vehicle which has been used to transport material marked as or known to be poison (Class A or B) must be inspected for contamination before reuse. A vehicle which has been contaminated must not be returned to service until such contamination has been removed. This paragraph does not apply to vehicles used solely for transporting such poisons so long as they are used in that service...."

49 CFR §177.861
Provisions for accidents involving radioactive materials.

EPA Regulations

40 CFR §165.10(c)(3)
"All items of movable equipment used for handling pesticides at the storage site which might be used for other purposes should be labeled 'contaminated with pesticides' and should not be removed from the site unless thoroughly decontaminated."

40 CFR §165.10(c)(4)
"Provision should be made for decontamination of personnel and equipment such as delivery trucks."

40 CFR §165.10(e)(1)(iv) and (v)
"In addition to precautions specified on the label and in the labeling, rules for personnel safety and accident prevention similar to those listed below should be available in areas where personnel congregate: Do not store pesticides next to food or feed or other articles intended for consumption by humans or animals. Inspect all vehicles prior to departure, and treat those found to be contaminated."

40 CFR §243.202-1(c)

"The equipment used in the transportation of solid waste shall be constructed, operated, and maintained in such a manner as to minimize health and safety hazards to the public."

40 CFR §263.20

"A transaporter may not accept hazardous waste from a generator unless it is accompanied by a manifest .... The transporter must deliver the entire quantity of hazardous waste which he has accepted from a generator or a transporter ... [to the designated facility] ...."

40 CFR §263.22

"A transporter of hazardous waste must keep a copy of the manifest ... for a period of three years from the date the hazardous waste was accepted by the initial transporter."

40 CFR §264.72

"(a) Manifest discrepancies are differences between the quantity or type of hazardous waste designated on the manifest or shipping paper, and the quantity or type of hazardous waste a facility actually receives. Significant discrepancies in quantity are: (1) For bulk waste, variations greater than 10 percent in weight, and (2) for batch waste, any variation in piece count, such as a discrepancy of one drum in a truckload. Significant discrepancies in type are obvious differences which can be discovered by inspection or waste analysis, such as waste solvent substituted for waste acid, or toxic constituents not reported on the manifest or shipping paper.

(b) Upon discovering a significant discrepancy, the owner or operator must attempt to reconcile the discrepancy with the waste generator or transporter (e.g., with telephone conversations). If the discrepancy is not resolved within 15 days after receiving the waste, the owner or operator must immediately submit to the Regional Administrator a letter describing the discrepancy and attempts to reconcile it, and a copy of the manifest or shipping paper at issue."

40 CFR §300.63

"... a release should be promptly reported to the NRC. Section 103(a) of CERCLA requires any person in charge of a vessel or facility to immediately notify the [National Response Center] NRC as soon as he has knowledge of a release (other than a federally permitted release) of a hazardous substance from such vessel or facility in an amount equal to or greater than the reportable quantity determined pursuant to section 102(b) of CERCLA ...."

40 CFR §761.40

Provisions for marking vehicles transporting PCBs.

Food and Drug Administration Regulations

21 CFR §110.80

"All operations in the receiving, inspecting, transporting ... [and segregation] of food shall be conducted in accord with adequate sanitation principles."

21 CFR §110.80(a)

"Raw materials and ingredients shall be inspected and segregated as necessary to assure that they are clean, wholesome, and fit for processing into human food .... Raw materials shall be washed or cleaned as required to remove soil or other contamination."

21 CFR §110.80(b)

"Containers and carriers of raw materials should be inspected on receipt to assure that their condition has not contributed to the contamination or deterioration of the products."

21 CFR §110.80(h)

"Packaging processes and materials shall not transmit contaminants or objectionable substances to the product ...."

21 CFR §110.80(j)

"Storage and transportation of finished products should be under such conditions as will prevent contamination ...."

21 CFR §211.82(a)

"Upon receipt and before acceptance, each container ... of components, drug product containers, and closures shall be examined visually for ... contamination."

21 CFR §225.42(b)(1)

"Incoming shipments of drugs [to be used in medicated animal feed] shall be visually examined for ... damage. Drugs which have been subjected to conditions which may have adversely affected their identity, strength, quality, or purity shall not be accepted for use."

21 CFR §225.65(a)

"Adequate cleanout procedures for all equipment used in the manufacture and distribution of medicated feeds are essential to maintain proper drug potency and avoid unsafe contamination of feeds with drugs. Such procedures may consist of cleaning by physical means, e.g., vacuuming, sweeping, washing, etc."

21 CFR §225.65(b)

"All equipment, including that used for storage, processing, mixing, conveying, and distribution that comes in contact with the active drug component, feeds in process, or finished medicated feed shall be subject to all reasonable and effective procedures to prevent unsafe contamination of manufactured feed. The steps used to prevent unsafe contamination of feeds shall include one or more of the following, or other equally effective procedures: (1) Such procedures shall, where appropriate, consist of physical means (vacuuming, sweeping, or washing), flushing, and/or sequential production of feeds."

21 CFR §226.40(b)

"All containers to be used for undiluted drugs, drug components, intermediate mixtures thereof, and Type A medicated article(s) shall be received ... in a manner adequate to avoid ... contamination."

21 CFR §226.40(f)

"All adequate procedures for cleaning ... equipment coming in contact with the drug component of the Type A medicated article(s) shall be used to avoid contamination of Type A medicated article(s)."

21 CFR §226.42(a)

"Drug components, including undiluted drugs and any intermediate mixes containing drugs used in the manufacturing and processing of Type A medicated article(s), shall be received ... in a manner to maintain the integrity ... of such articles."

Nuclear Regulatory Commission Regulations

10 CFR §20.311(c)

Disposal of licensed wastes is regulated in 10 CFR Part 20.301 through 20.311. In particular, no licensee shall dispose of licensed material except by transfer to an authorized recipient [10 CFR 20.301], and a manifest tracking system is required to ensure proper tracking and control. (10 CFR 20.311) The manifest must certify that "... the transported materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of DOT and NRC."

10 CFR §71.5(a)(2)

Each licensee who transports licensed material outside of the confines of its plant or other place of use, or who delivers licensed material to a carrier for transport, shall comply with the applicable requirements of the regulations appropriate to the mode of transport of DOT in 49 CFR Parts 170 through 198." 10 CFR 71.5(a). The section specifically notes DOT regulations on packaging, marking, and labeling, placarding, monitoring, accident reporting, and shipping papers 10 CFR 71.5(a)(1), and DOT regulations pertaining to the various modes of transportation.

10 CFR §71.5(b)

In addition, if DOT regulations are not applicable because the shipment or transportation is not in interstate or foreign commerce, "... the licensee shall conform to the standards and requirements of DOT specified in 10 CFR 71.5(a) to the same extent as if the shipment or transportation were in interstate or foreign commerce or civil aircraft."

APPENDIX B

PERSONS CONTACTED

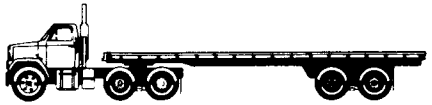
Ronald Anderson	USDA
Daniel Bannister	Transport Resources
Robert Bastian	EPA
Dr. Val Beasley	University of Illinois College of Veterinary Medicine
Claude Beaudoin	Milestone (Cleaning)
William Blanchette	Bio Gro Systems (Sludge Hauler)
James Boland	EPA
Dr. Emmett Braselton	State University of Michigan (Analytical Toxicology Laboratory)
Timothy Burbrink	Consolidated Freightways
Brian Burns	CECOS (Waste Cleanup)
Freeman Buxton	USDA
Dr. William Colvin	Diagnostic Laboratory, Georgia
Kevin Connors	Chemical Waste Management (Waste Cleanup)
Gerry Cox	Chemical Manufacturers Association
John Currie	American Trucking Associations
Dennis Deering	CENEX (Cooperative)
Ron DeNoville	Crawford and Company
David Dorth	EPA
Richard Doyle	Chemical Manufacturers Association
Steve Dreisen	Massachusetts Division of Environmental Quality and Engineering
Thomas Ducey	American International Group (Insurance)
John Elliot	Liberty Mutual (Insurance)
Robert S. Faron	Barnett and Alagia
Norris Freeman	DOT
Commander Larry Gibson	U.S. Coast Guard
Dr. Glass	FDA
David Goodman	DOT
Kent Grey	Center for Disease Control
Paul Grossman	Interstate Commerce Commission
Steve Guveyan	Better Home Heating Council
Clifford Harvison	National Tank Truck Carriers
David Hansen	Cargil
Dr. Wayland J. Hayes, Jr.	Vanderbilt University School of Medicine
Rolf Hill	EPA
Cynthia Hilton	Chemical Waste Transporters Council
Roy Holden	Association of American Railroads
Alan Housh	Cargil
August Iacovitti	Buffalo Fuel Corporation
Steven James	FDA
Paul Jansen	Monsanto
Dr. Roger Kasperson	Clark University
Kevin Kiley	Massachusetts Motor Transport Association
Dr. Renata Kimbrough	Center for Disease Control
Paul Kromberg	Association of American Railroads

Genevieve Laffly	American Petroleum Institute
Thomas Lang	Dad's Dog Food
George Lehman	Shell Chemical Company
Jack Leonard	Indianapolis Center for Advanced Research
Ken Leonard	American Petroleum Institute
Lt. Robert Long	New Jersey State Police Hazardous Materials Transportation Unit
John Mailing	United Coverage Consultants (Insurance)
Dr. Dan McGrew	Hazardous Materials Control Research Institute
Eugene Meenan	Matlack (Trucking)
John Mehling	United Coverage Consultants, Inc.
Paul Melander	Tennessee Public Service Commission
Robert Mesecher	Michigan Department of Agriculture
Fred Millar	Environmental Policy Institute
Dr. James P. Minard	State Chemical Office (Mississippi)
Randall Monteith	City of Akron (Sewage Treatment Plant)
Kathy Morrisat	Shell Oil Company
Ralph Nappi	Transport Resources (Cleaning)
Debbie Nicoll	EPA
William Niggel	Mobay Chemical Corporation
Richard O'Boyle	Quality Carriers, Inc.
Michael O'Connell	Collier, Shannon, Rill & Scott
Edith Page	Office of Technology Assessment
Robert Pepperman	Enviro Gro Technology (Sludge Hauler)
Susan Peres	Federal Emergency Management Administration
Dr. Robert Pojasek	Chemcycle Corporation
Frank Punt	DOT
Capt. Pete Rickheit	Massachusetts State Police
Commander Kenneth Rock	U.S. Coast Guard
James Roof	Summerdale Laboratory, Pennsylvania
Albert Rosenbaum	National Tank Truck Carriers, Inc.
Frank Ross	National Veterinary Services Laboratory, FDA
Officer Neil Ross	New York State Department of Environmental Conservation
Caroline Russ	Clean Harbors, Inc.
Robert Sanders	FDA
Fred Schloffler	New England Interstate Water Pollution Control Commission
Lee Schonfeld	Association of American Railroads
Devin Scott	American Meat Institute
Peter Shandruk	FDA
Henry Seiff	Motor Vehicle Manufacturers Association
Harry Silverstrum	Albin Pump
Robert Southworth	EPA
Robert Spencer	FDA
Todd Spencer	Independent Truckers Association
Bruce Swonger	Metropolitan Environmental (Waste Cleanup)
Mary Synder	FDA
Dr. Alicen Tepper	New Jersey Department of Health
John Tisler	FDA
Steven VanRenssellaer	Rohm & Haas Chemical Company

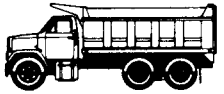
Timothy Vendinski	EPA
Richard Webber	USDA
John Wessel	FDA
Gerry Wilkins	Chemical Lehman (Trucking)
Bruce Williams	Dow Chemical Company
David Williams	EPA

Examples of Trucks and Rail Cars

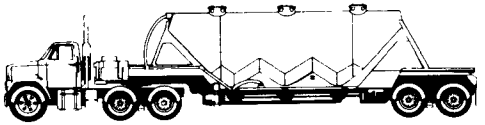
Beverage



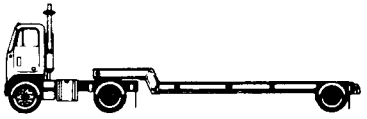
Cargo Container Chassis



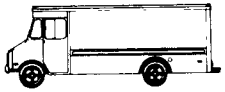
Dump Truck



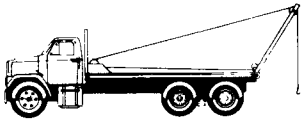
Grain Body



Low Boy



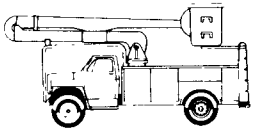
Multistop/Walk In



Oilfield Truck

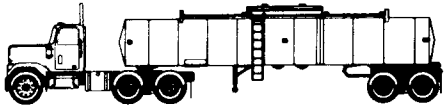
Pick-Up

Platform Type

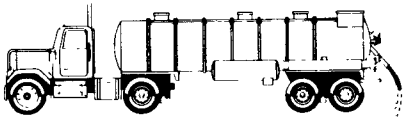


Public Utility

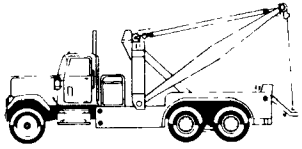
Service Truck



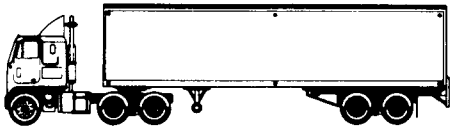
Tank Truck



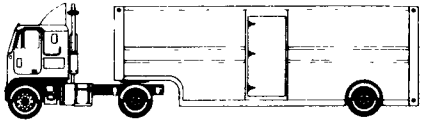
Tank Truck (Dry Bulk)



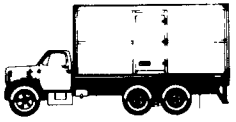
Winch/Crane



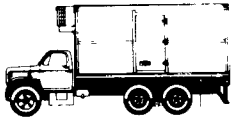
Basic Enclosed Van



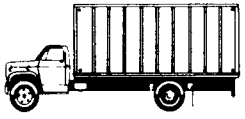
Drop-Frame Van



Insulated Nonrefrigerated Van

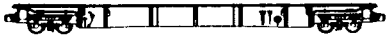


Insulated Refrigerated Van

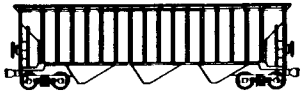


Open Top Van

Panel or Van



Flat Car



Hopper Car

Refrigerator Car

Tank Car

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